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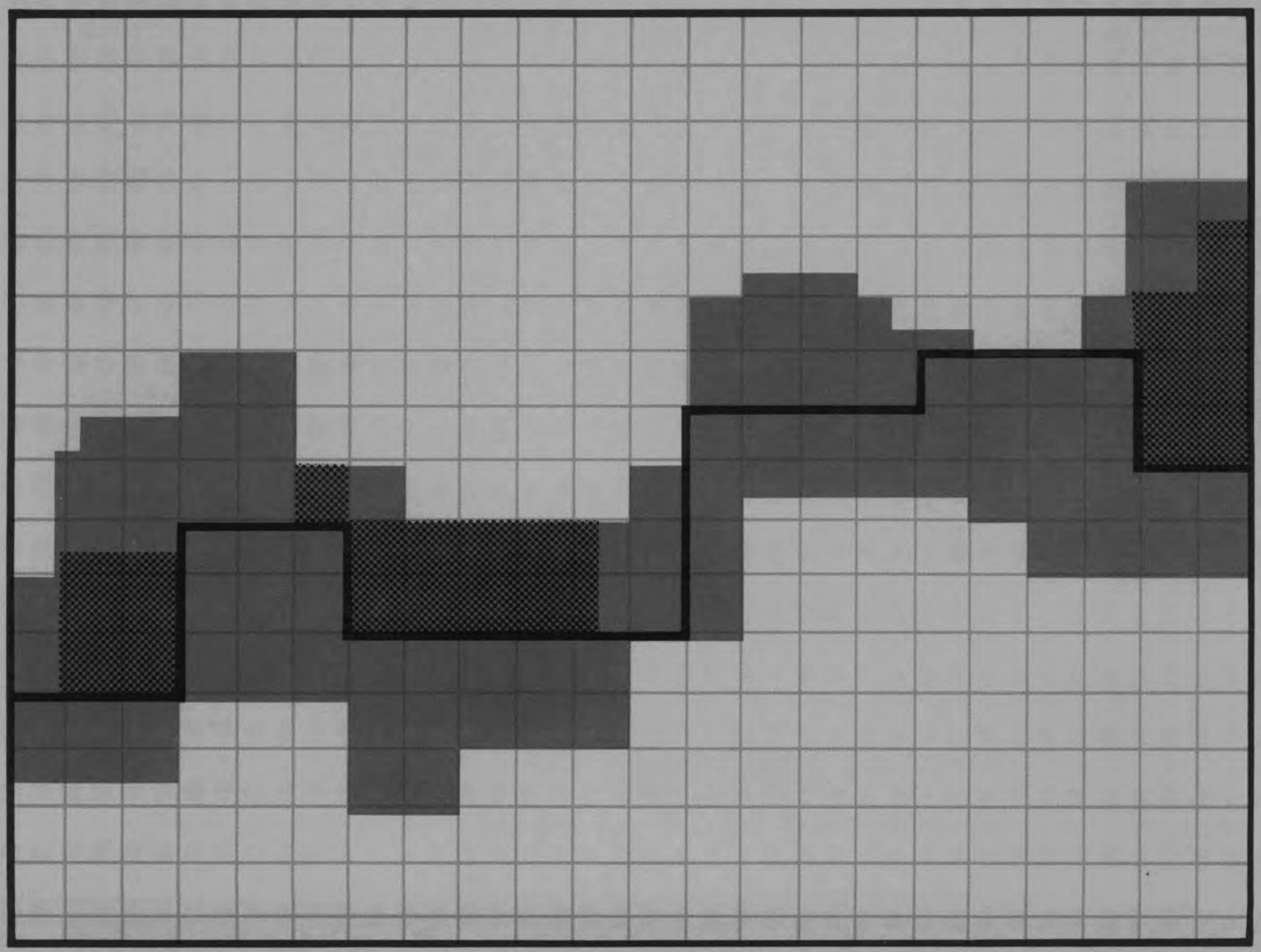

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The New Procedure

by E.J. Stevens

The Federal Reserve began setting money-growth targets in 1970. Dissatisfied with its marksmanship in the 1970s, it introduced a new procedure for achieving money-growth targets in October 1979. Because the Federal Reserve does not issue all of the money it seeks to control, it must employ a technique that will induce the public—including consumers, businesses, banks, and other deposit-issuing institutions—to demand and supply the targeted quantity of money. The Federal Open Market Committee (FOMC) sets policy at periodic meetings during the year, typically choosing long-term (fourth-quarter to fourth-quarter) money-growth targets at two meetings and shorter-term target paths at each meeting. Instructions from these meetings guide daily open-market operations of the trading desk as it manages the supply of depository-institution reserves. A major difference between the old and new procedures lies in the form of these instructions, contained in the FOMC policy directives.[1]

This article describes the new reserve-targeting procedure, briefly characterizes policy implementation with the procedure in 1980-81, and examines some suggested modifications to the procedure.

I. Old and New: An Overview

Prior to October 1979, the FOMC directed the trading desk to maintain the federal-funds rate within a narrow band estimated by the FOMC to be consistent with desired money growth. In addition, the directive specified how the trading desk should adjust the level of the funds rate when incoming information showed a deviation of money growth from a desired range. The rationale for using the funds rate to control money growth was that variations in this interest rate indicate variations in the price of holding non-interest-bearing and fixed-rate money balances. An increase in the funds rate and associated money-market rates thus tends to reduce money demand and retard money growth, while a decrease has the opposite effect.

The old procedure for controlling money growth riveted the attention of both the Federal Reserve and the financial markets on the funds rate. If the rate tended to drift up or down during the day and the trading desk responded by adding or withdrawing reserves, then the market was able to infer the desired funds rate. If, on the other hand, the rate were allowed to move up or down to a new trading range without intervention, or if the desk intervened to move the rate to a new range, then the market had a signal that the desired funds rate was changing. In this way, market participants' expectations about money-market conditions and money growth were continuously reinforced or changed by policy operations.

Under the old procedure the funds rate tended to move too slowly to maintain money growth within target ranges. By the time the funds rate moved up or down enough to correct deviations of money growth from a range around the target path, cumulative deviations from the path were large and targets often were missed.

The new procedure focuses day-to-day on the quantity of nonborrowed reserves rather than the level of the funds rate. The FOMC establishes long-

1. The policy directive issued at an FOMC meeting is contained in the "Record of Policy Actions of the Federal Open Market Committee" released on the Friday following the next meeting and published in the *Federal Reserve Bulletin.*

E.J. Stevens is an economic advisor with the Federal Reserve Bank of Cleveland.

run and short-run money targets, as before, and indicates a broad federal-funds rate range that is thought to be consistent with those targets. However, the FOMC specifies neither a level of the funds rate to be maintained when money growth is on the desired path, nor an amount by which the funds rate should move if money growth deviates from that target path. Instead, the trading desk is directed to maintain a supply of nonborrowed reserves estimated to be consistent with the target path for money growth and a residual amount of discount-window borrowing. If actual money growth turns out to be above or below the FOMC's target path, targeted nonborrowed reserves will supply a smaller or larger portion of total reserve demand. In effect, the new procedure requires that reserve needs caused by above-target money growth be financed at the discount window, while shortfalls of reserve needs caused by below-target money growth reduce the amount depository institutions must borrow at the discount window. Given the demand for required reserves and some demand for excess reserves, borrowed reserves must make up the difference between the targeted supply of nonborrowed reserves and the demand for total reserves.

Emphasis on the quantity of nonborrowed reserves does not mean that policy actions have no influence on interest rates in general, or the funds rate in particular. When money grows at a rate different from the target rate, adherence to a predetermined path for nonborrowed reserves implies that interest rates will be forced up or down in the market for bank reserves. For example, when money runs above target, reserve demands expand, and reserves must be obtained from the window. This causes the funds rate to rise because, given the limited amount and frequency of adjustment credit the Federal Reserve will extend to any borrower, institutions are reluctant to borrow from the discount window and would rather borrow in the federal-funds market even at a higher interest rate. The larger the amount of adjustment borrowing that institutions must do, and the longer they must do it, the larger is the premium they are willing to pay in the funds market, as measured by the spread of the funds rate above the discount rate, in order to avoid further borrowing from the discount window (see figure 1).

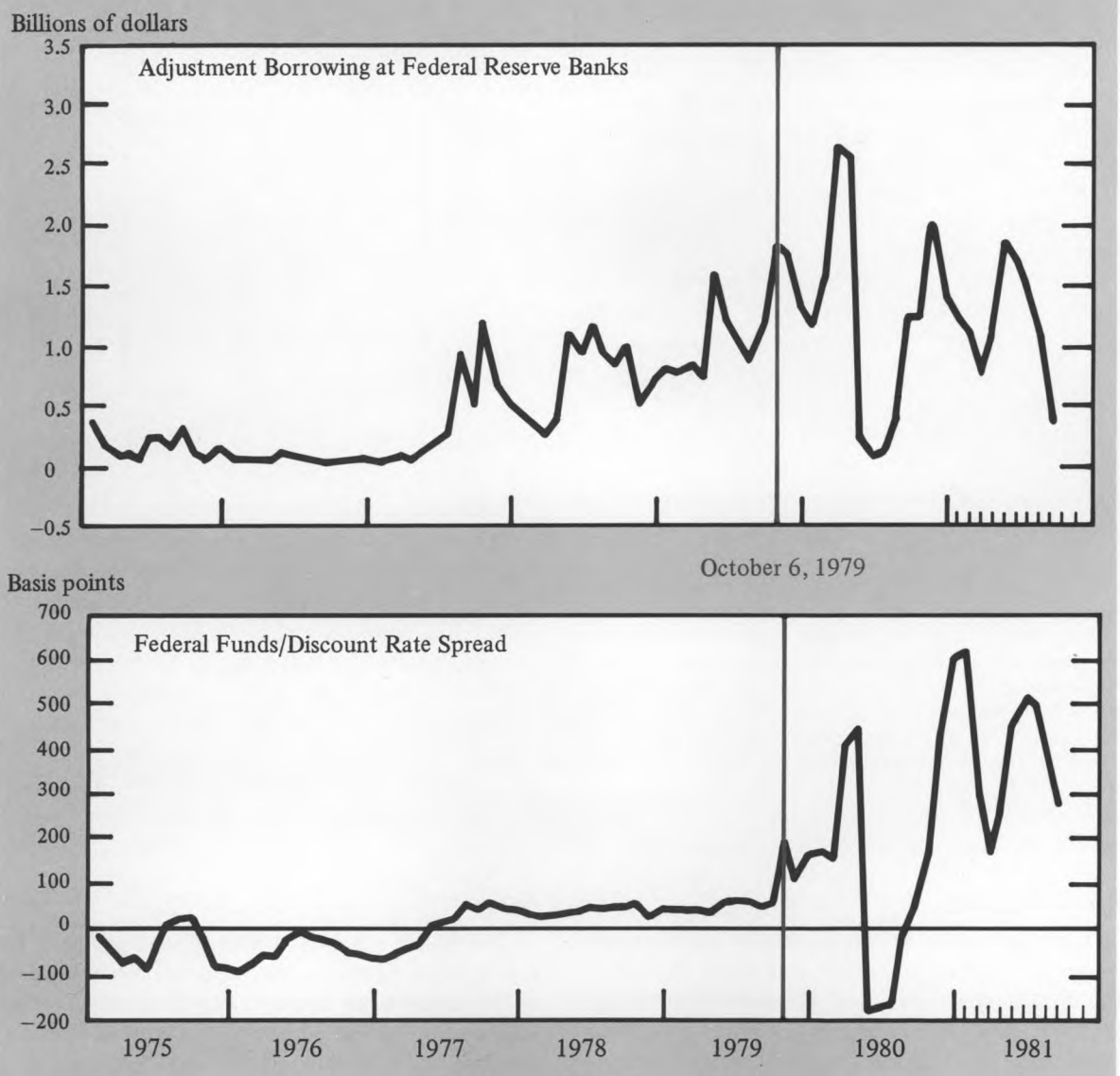
Thus, a major difference between the old and new procedures is the way the funds rate is determined. Rather than having the trading desk maintain a target level of the funds rate through open-market operations, the new procedure relies on the market to establish the funds rate. The rate settles at whatever spread above or below the discount rate is required to overcome the reluctance of reserve-holding institutions to borrow an amount from the discount window equal to the difference between their aggregate demand for total reserves and the supply of nonborrowed reserves.

Major features of the new procedure are the determination of the quantities of both total and nonborrowed reserves for a reserve-requirement maintenance period (currently one week) and the funds rate (see figure 2). The simple framework in figure 2 illustrates how the funds rate is determined in the short run, but not how money targets are achieved in the longer run. Essentially, the quantity of nonborrowed reserves and the level of the discount rate must be managed over a series of many weeks so that the funds rate and related money-market rates will produce the targeted quantity of money. The details of this management process describe monetary policymaking under the new procedure.

II. The Details

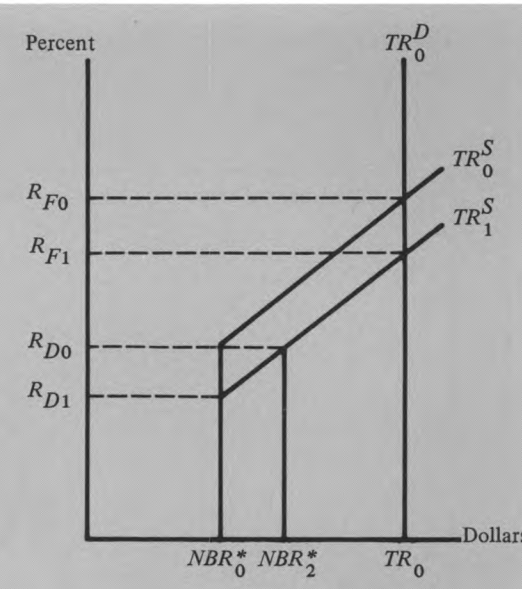
Mechanics of policymaking under the new procedure can be described in five steps, each step representing a translation of policy from less to more specificity. Step one translates FOMC economic policy into money-growth target ranges for a year. Step two translates those annual-growth ranges into a target path for seasonally adjusted levels of the monetary aggregates for the time period between FOMC meetings. Neither of these first two steps differs substantially from the old procedure, but the next three do. Step three translates targeted money paths into an objective for the average nonseasonally adjusted level of total and nonborrowed reserves for the inter-FOMC meeting period. Step four translates those inter-meeting objectives into a trading desk supply objective for the average level of nonborrowed reserves in a reserve-maintenance week. Step five translates that weekly objective into a daily program for open-market operations of the trading desk in the money market.

Fig.1 Discount Window Borrowing and the Rate Spread
Data plotted monthly



The association between discount borrowing and the rate spread that was apparent under the old procedure has continued under the new procedure, although the direction of causality has been reversed. Prior to October 1979, the FOMC determined the funds rate, and, given the discount rate, a higher rate spread overcame reluctance to borrow; the rate spread determined borrowing. Since then, the FOMC has determined the nonborrowed-reserve path. Given the demand for reserves in the short run, a higher need for borrowed reserves forces the funds rate to rise; the aggregate amount of borrowing determines the rate spread.

Fig. 2 The Federal Funds Rate



Given a demand for total reserves, TR^D_0, greater than the supply of nonborrowed reserves maintained by the desk, NBR^*_0, and given the discount rate, R_{D0}, there is some level of the funds rate, R_{F0}, that would equilibrate the market for reserves in a reserve-maintenance week by overcoming the reluctance of institutions to borrow at the discount window.[1] This relationship is shown as TR^S. Discount borrowing would equal $TR_0 - NBR^*_0$.

Clearly, both the level of the funds rate and the amount of borrowed reserves depend on the setting of the policy instrument, NBR^*_0, as well as on the level of the discount rate, R_D. For example, suppose TR^D_0 and NBR^*_0 were unchanged but the discount rate were not R_{D0} but a lower rate, R_{D1}. The relationship between the funds rate and the quantity of reserves to be borrowed would shift down to TR^S_1, because it would take a lower funds rate to overcome reluctance to borrow any given amount of reserves at the lower discount rate. The equilibrium funds rate would therefore be R_{F1}, a lower rate than R_{F0} because of the lower discount rate. Alternatively, suppose the discount rate were at the original level, R_{D0}, and demand for total reserves were unchanged at TR^D_0 but that the trading desk maintained a larger quantity of nonborrowed reserves, NBR^*_2. The resulting funds rate is much the same as that from a reduction in the discount rate. Given the demand for total reserves, the equilibrium funds rate would be lower, reflecting the smaller amount of borrowing to be induced.

1. TR^D_0 is drawn as a vertical line on the assumption that the interest elasticity of demand for total reserves is negligible within a reserve maintenance week. Lagged-reserve accounting assures that the required reserve component of total reserves is completely interest inelastic during the reserve period; deposits two weeks ago cannot be altered this week. If TR^D_0 is not vertical, it must reflect the interest elasticity of excess reserves; this would impart only a slight degree of curvature to TR^D_0, because excess reserves normally total less than 1 percent of total reserves.

Step One

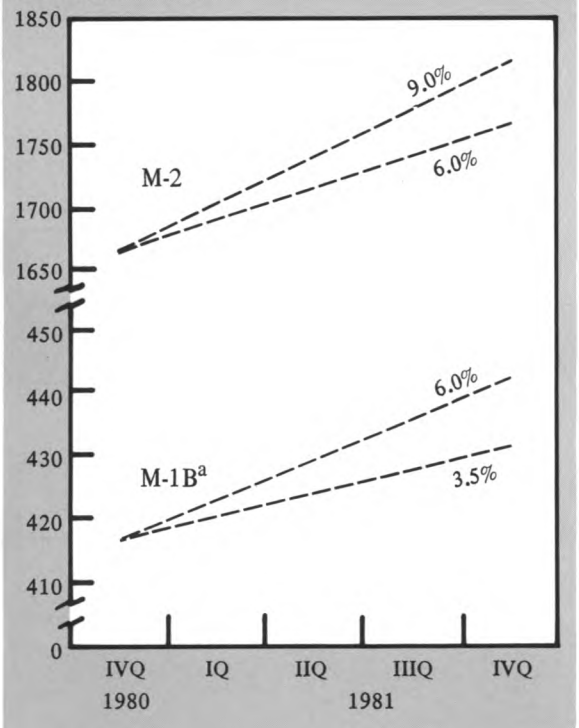
This step is the FOMC process of setting target ranges for growth of money and credit aggregates. The Full Employment and Balanced Growth Act of 1978 (Humphrey-Hawkins) requires that these target ranges be reported to Congress each year in February. An update of the current year's targets and a preliminary view of the following year's targets are presented in July of each year. Reflecting uncertainty about the exact relationship between money and economic conditions and about the precision of monetary control, these targets are expressed as a range within which growth rates of aggregates should lie, expressed on a fourth-quarter to fourth-quarter basis (see figure 3).

Step Two

The FOMC chooses a short-run target path for one or more monetary aggregates (M). Each is related to the annual-target range for that M and is consistent with the comparable path selected for every other targeted M. A short-run money target implies a time path of interest rates likely to be consistent with growth of money demand at the target rate.

The FOMC has considerable discretion in choosing short-run target paths at FOMC meetings during the year. For example, if the FOMC started a year by targeting the midpoint of the long-run range, but money growth substantially exceeded that path one quarter into the year, then the FOMC could adopt a short-run target path to regain the original

Fig. 3 Annual Target Ranges



a. Adjusted for NOW-account-related shifts in deposits.

path anywhere from one quarter to three quarters later. Alternatively, the FOMC could adopt a short-run path that never regained the midpoint, but remained within the original target-growth range. The choice among alternative short-run paths presumably reflects some judgment about the actual situation, such as whether a strengthening real economy or shifting demands for financial instruments were at work, or whether it would be too costly to achieve a desired adjustment in money within the remaining months of the year. The possibilities for short-run paths are illustrated by actual M-1B paths for inter-meeting periods chosen by the FOMC during 1980-81 (see figure 4).

Short-run target paths link policy actions and actual money growth during the course of the year to the target range for money growth over the whole year. Because money growth does not respond quickly to reserve-management operations, money growth only rarely follows the short-run target paths. Nonetheless, under present procedures, deviations of actual money growth from short-run paths automatically trigger market reactions, tending to return money growth to path. The next three steps define those reactions.

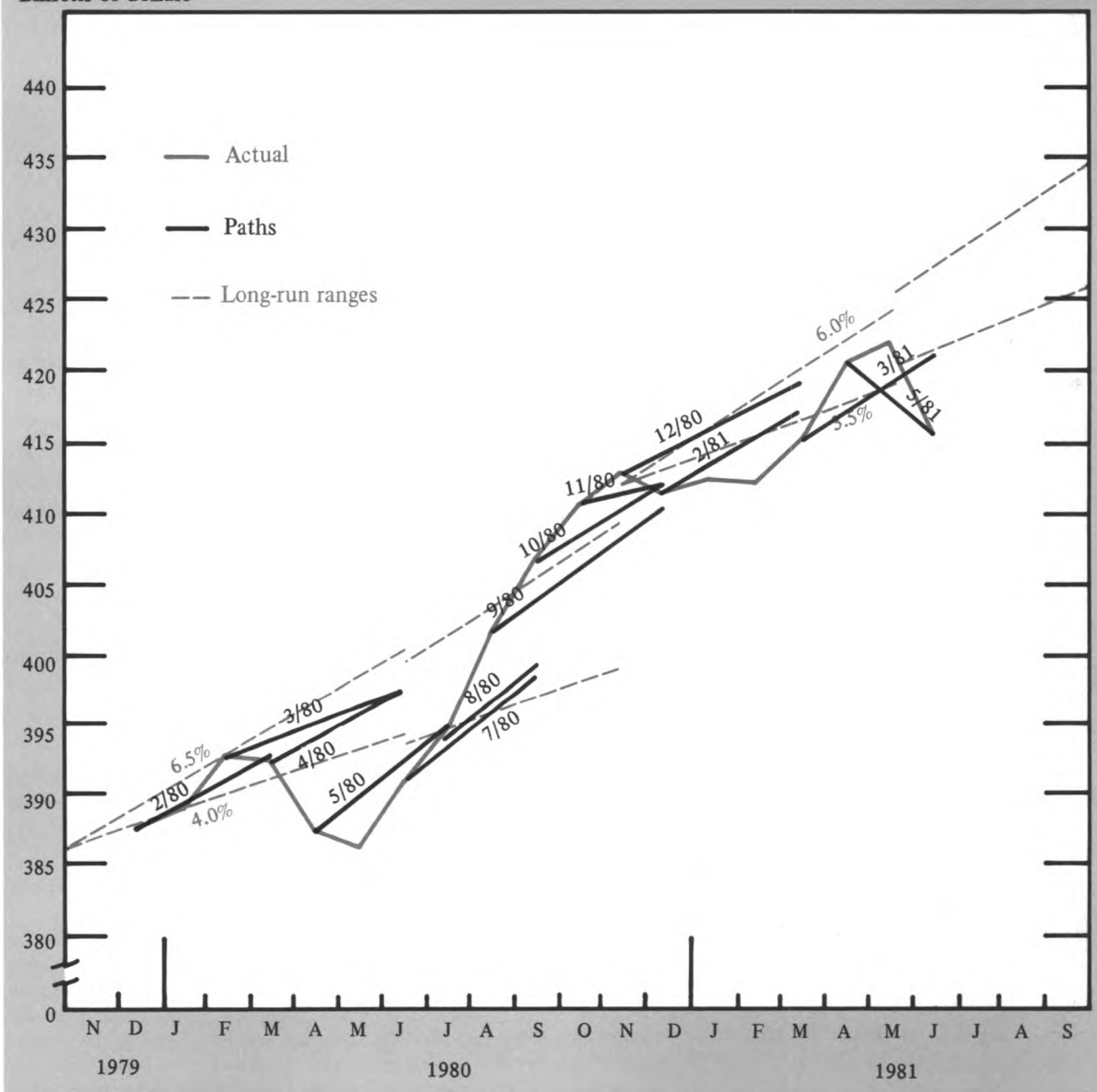
Step Three

The two preceding steps occur in the FOMC, both organizationally and chronologically prior to involvement of the trading desk. These steps usually result in three decisions that define FOMC policy over an inter-meeting period: the short-run target money path for M-1B; an initial assumption about residual borrowing; and a federal-funds rate range. The first two are the basis for constructing a nonborrowed-reserve path to guide inter-meeting open-market operations of the trading desk. The funds-rate range provides a trigger for FOMC reconsideration of money, total reserve, and nonborrowed-reserve target paths if expectations about market conditions at the time of the meeting are not fulfilled: if the average funds rate threatens to fall outside the stipulated range, then the desk notifies the chairman.[2]

The short-run path for money growth is translated into a path value for the average level of total reserves during an inter-meeting period. Predetermined seasonal factors are used to derive the inter-meeting average and weekly non-seasonally adjusted target paths of money and total reserves from the seasonally adjusted money path in the FOMC directive. The non-seasonally adjusted total-reserve path is obtained after projecting the currency component of

2. Until December 1980 the directive indicated that the FOMC sought reserve aggregates consistent with its money targets, provided that the weekly average federal-funds rate remained within a stipulated range. Starting in December 1980, the directive specified that if fluctuations in the federal-funds rate "taken over a period of time" within the stipulated range were likely to be inconsistent with the money and reserve paths, then the chairman might seek supplementary instructions from the FOMC. The May 1981 and subsequent directives stated that the chairman might consult with the FOMC if "pursuit of the monetary objectives and reserve paths" were "likely to be associated with a federal-funds rate persistently outside" the stipulated range. More recent directives also indicate that the FOMC sought reserve aggregates consistent with its M-1B targets provided that M-2 growth remained "around the upper limit of, or moves within, its range for the year."

Fig. 4 M-1B and Inter-Meeting Paths: 1980-81



At each of its meetings since January 1980, the FOMC has chosen a short-run target path for M-1B growth that can be related to the long-run growth-rate target range.[1] Each of the short-run paths chosen at meetings from February through August 1980 would have brought the level of M-1B toward the midpoint of the 4 percent to 6.5 percent long-run growth-rate range in 1980. At the September meeting, the short-run path was above the long-run midpoint but would have kept year-end M-1B below the upper end of the long-run range. The short-run

1. Target paths are specified in the "Record of Policy Actions of the Federal Open Market Committee" for each meeting. The record is released after the next meeting and subsequently published in the *Federal Reserve Bulletin*.

path chosen at the October and November meetings would have placed M-1B above the fourth-quarter level and somewhat above the December level implied by the upper limit of the original long-run target range (without any upward adjustment of that range to reflect unexpected growth of other checkable deposits).

At the December meeting, with the 1980 outcome essentially impervious to policy influence, the short-run path adopted lay along the midpoint of the preliminary long-run target range for 1981. At the following meeting in February 1981, the long-run range for 1981 was confirmed, and the short-run path adopted would have brought the level of M-1B up to the midpoint of the long-run range early in the fourth quarter of 1981. The short-run maximum-growth path chosen at the March 1981 meeting would have placed M-1B above the lower limit of the long-run range in the third quarter of 1981, although still below the midpoint at year-end. The directive adopted at the May 1981 meeting called for M-1B growth of 3 percent "or less" from April to June; in fact, M-1B declined at a 6.7 percent rate from April to June, and this is assumed to have been the short-run path.

In the accompanying figure, the month designated on each short-run target path refers to the meeting date at which that path was chosen. The path shown was from the most recent month for which the committee had data to the endpoint month of the target path chosen. At the March 1980 meeting, for example, the path chosen specified a 5 percent rate of M-1B growth from December to June; the March path, therefore, was based on the actual February level of M-1B and ended at a June level 5 percent (ar) above December. The actual levels of M-1B shown do not incorporate benchmark revisions, because this information was not available to the FOMC at the time decisions were made. The long-run target ranges are discontinuous, shifting at the months when benchmark revisions of base-period data were incorporated into target setting. Reflecting the way in which the actual targets were set, 1981 data are adjusted for substitution of other checkable deposits for non-M-1B assets (as described in the Board of Governors press release H.6).

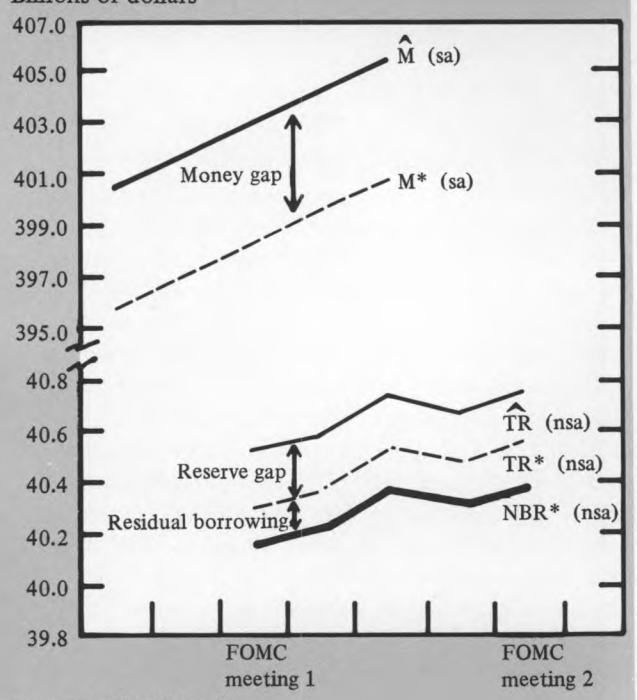
money and the levels of required and excess reserves consistent with the deposit component of the money path and projected levels of non-M-1B reservable liabilities. Depository-institution reserves, in the form of vault cash and deposit balances at Federal Reserve Banks, as specified by Regulation D, must equal a percentage of an institution's deposit liabilities plus any amount that institutions choose to keep in excess of requirements.

The initial nonborrowed-reserve path is determined by the difference between the total reserve path and an initial assumption about the level of residual adjustment borrowing.[3] Given the discount rate, the combination of these two sources of reserves would be expected to result in a funds rate and other money-market rates consistent with growth of money demand along the target path. However, if a gap opens between actual money growth and the inter-meeting path, a comparable gap would open between the actual level of reserve demand and the path for average total reserves during the inter-meeting period. This reserve gap is the volume of reserves required to accommodate the excess (or not required because of the deficiency) of targeted deposits above (below) the levels consistent with the money path (see figure 5).

A total reserve objective cannot be met—a reserve gap will exist—as long as money growth is not on path. This is because required reserves are predetermined by the deposit level two weeks earlier. A nonborrowed-reserve objective *can* be achieved, however, because accommodation of the reserve gap occurs at the discount window. When a positive gap develops (total reserves in excess of path), institutions are forced to borrow more; in an effort to avoid increased borrowing, the funds rate is bid up until reluctance to borrow at the discount window is overcome. Moreover, a higher level of the funds rate and other money-market rates serves to dampen the demand for money. In subsequent reserve periods, this will bring money and total reserves back toward the target path, other things equal. As a negative gap develops, the opposite automatic adjustment takes place.

3. Adjustment borrowing excludes seasonal and special loans for extended periods of time that, for policy-implementation purposes, are analogous to nonborrowed reserves.

Fig. 5 Money and Reserve Gaps



sa—seasonally adjusted
nsa—non-seasonally adjusted

At meeting 1 the FOMC adopts a monthly target path for seasonally adjusted money (M^*). Reserve requirements determine a required reserve path consistent with M^* after taking account of seasonal factors, expected holdings of currency, and non-M-1B reservable liabilities. The addition of expected holdings of excess reserves then produces a non-seasonally adjusted path for total reserves for the inter-meeting period (TR^*). The path for nonborrowed reserves (NBR^*) is derived by subtracting an initial residual borrowing assumption that, given the prevailing discount rate, would be expected to result in a level of the funds rate consistent with demand for money equal to the target path.

Actual levels of money ($\hat{M}$), of course, might differ from M^*, reflecting short-run variations around the trend rate of growth of money demand, shifts in money demand, or the effects on money demand of unexpected changes in economic activity or interest rates. Actual demand for total reserves ($\hat{TR}$) would exceed TR^* if the actual level of money ($\hat{M}$) exceeded M^*. Nonetheless, the procedure would call for only providing nonborrowed reserves of NBR^* so that actual borrowing ($\hat{TR} - NBR^*$) would have to exceed the residual borrowing assumption by the entire amount of the reserve gap, equal to the difference between $\hat{TR}$ and TR^*.

Step Four

As the inter-meeting period progresses, the desk aims at the inter-meeting nonborrowed-reserve objective, subject to technical corrections and judgmental adjustments.[4]

Technical corrections to the inter-meeting total-reserve objective may be made each week of the inter-meeting period, based on incoming information. Tabulation of an additional week's money and reserve data makes it possible to improve estimates of the simple multiplier relationship between total reserves and money. More or less reserves may be required than when objectives initially were set, because of unforeseen shifts in the levels of excess reserves and of non-M-1B reservable deposits or in the distribution of a given level of deposits between high and low reserve-requirement instruments and institutions. Similarly, unforeseen variations in currency holdings alter the volume of deposits and required reserves consistent with the money path. All these multiplier corrections change the total-reserve objective. With the residual-borrowing assumption

4. These technical corrections and judgmental adjustments are made by the staff to implement the directive of the FOMC. The FOMC itself may hold interim meetings (typically by telephone) and decide to amend the directive, which might then change the inter-meeting total and/or nonborrowed-reserve objectives. Such interim meetings can be triggered as inconsistencies develop between the money paths and funds-rate range. When such inconsistencies occurred in 1980-81, the FOMC typically agreed to amend the funds-rate range rather than the money paths. On the one occasion when the money paths were amended, the funds rate remained outside the directive range despite the amendment.

unchanged, they change the nonborrowed-reserve objective by the same amount.

Judgmental adjustments of the inter-meeting nonborrowed-reserve objective might take place for three reasons. First, in the very short run and typically at the end of a reserve-maintenance week, intentional misses of the nonborrowed objective are sometimes preferred to forcing a sharp change in money-market conditions. For example, borrowing for the first six days of a reserve-maintenance week might be substantially above the amount thought to be consistent with actual total-reserve needs and the nonborrowed objective for the week; yet it might be consistent with the reserve objective and money-market conditions foreseen for future weeks. Hitting the nonborrowed target for the week would be likely to produce substantial excess reserves and a decline in the funds rate that might tend to mislead the market about policy objectives. Therefore, intentionally undershooting the nonborrowed objective may be preferable. This amounts to a short-run judgment to adjust the nonborrowed-reserve objective by revising the residual-borrowing assumption, while leaving the total-reserve objective unchanged.

Second, the residual-borrowing assumption may be revised to reflect an apparent shift in demand for borrowed reserves (given the discount rate). For example, suppose that the rate spread associated with adjustment borrowing were persistently higher than the spread assumed in prior settings of the residual-borrowing assumption; other things being equal, money growth then would be expected to fall short of the path consistent with the initial nonborrowed-reserve objective, suggesting the need for an adjustment in that objective. Such an adjustment represents a revision of the residual-borrowing assumption that leaves the total-reserve objective unaltered but adjusts the nonborrowed objective.

Third, it might be decided that actual money and total-reserve growth were not returning to path promptly enough. Therefore, the nonborrowed-reserve objective might be changed to reinforce the automatic effect of the reserve gap in altering money-market conditions to control money growth.

In summary, technical corrections and judgmental adjustments to the inter-meeting nonborrowed-reserve objective may occur each week. They take two forms. Technical corrections revise both total and nonborrowed-reserve objectives by equal amounts, leaving the residual-borrowing assumption unchanged. Judgmental adjustments revise this residual-borrowing assumption to change the mix of borrowed and nonborrowed reserves, but leave the total-reserve objective unchanged.

Although the desk supplies nonborrowed reserves between FOMC meetings in a weekly pattern that averages to the inter-meeting objective, this weekly pattern mimics the actual weekly pattern in non-seasonally adjusted total-reserve demand. Money, whether on or off target path, does not grow at a steady rate week-by-week before seasonal adjustment. The actual process is complex, but an outline of the method of deriving the weekly nonborrowed-reserve objective for any week consistent with the adjusted inter-meeting period objective is relatively simple. The target-path average for total reserves is subtracted from the average of actual and projected weekly total-reserve demands for the inter-meeting period. This defines the average reserve gap that must be financed at the discount window, in addition to the assumed amount of residual borrowing as modified by any judgmental adjustments to the nonborrowed-reserve objective. The reserve gap (positive or negative) plus residual borrowing, when multiplied by the number of weeks in the period, define the projected sum of weekly total borrowed reserves for the entire inter-meeting period. Subtracting the sum of weekly actual borrowing in prior weeks of the inter-meeting period and then dividing by the number of weeks remaining in the period defines average weekly borrowing in current and subsequent weeks of the period that would be consistent with the average nonborrowed-reserve objective for the entire inter-meeting period. Subtracting this amount of average weekly borrowing from projected total-reserve demand for the current week provides the nonborrowed-reserve objective for the week.[5]

Step Five

The chronology of desk operations during a week starts on Thursday, when a new reserve-accounting

5. Note that this process of setting weekly nonborrowed-reserve objectives contains a correction for any past error in setting the weekly level of nonborrowed reserves that is distributed over succeeding weeks of the target period.

period begins. Thursday's desk program must be tentative, however, because information required to adjust inter-meeting reserve objectives usually is not available until Friday morning. On Friday, the nonborrowed-reserve objective for the current reserve-maintenance week normally can be set, reflecting any technical corrections and judgmental adjustments to the inter-meeting reserve objectives and offsetting any target miss in the previous week. Each morning, the target for the week is compared with fresh estimates of the supply of reserves for the week. Any difference between target and estimated supply defines the estimated open-market operations for the day (adjusted for the number of days that reserves are affected) that would be required to achieve the weekly nonborrowed-reserve objective; this estimate is one basis for the desk's market program for the day. This program is discussed each day with FOMC staff in a morning telephone conference call monitored by one of the four non-New York Federal Reserve Bank presidents who are voting members of the FOMC.

Estimates of the average daily supply of reserves for a reserve-maintenance week are updated daily by the staff of the Federal Reserve Bank of New York and, independently, by the staff of the Board of Governors. These estimates involve projections of market factors supplying and absorbing reserve funds, some of which are highly volatile day to day and therefore impart significant uncertainty to the estimated open-market operations required to achieve the weekly nonborrowed-reserve objective. The desk program for operations in the market on any day is therefore not necessarily a duplicate of the day's estimate of over- or undersupply of nonborrowed reserves. Seasoned judgment, plus qualitative and sometimes fragmentary additional information, is an indispensible foundation for daily open-market operations of the desk.

III. The New Procedure in Practice

The new reserve-targeting procedure involves daily activities by the trading desk that will lead to control of nonborrowed reserves. A nonborrowed-reserve target, however, is merely that portion of total-reserve demand *not* supplied by adjustment borrowing: total-reserve demand minus the reserve gap forced into the discount window equals the total-reserve path; the total-reserve path minus residual borrowing equals the nonborrowed-reserve path.

The essentials of the new procedure for implementing monetary policy therefore are contained in the two determinants of total-adjustment borrowing at the discount window. One is the calculated reserve gap created by the excess or shortfall of money relative to the FOMC's target path. This reserve gap is an automatic element of policy that, taken by itself, would cause borrowing to rise or fall as money growth exceeded or fell below the target path. The other determinant of total-adjustment borrowing is the residual amount that is built into the nonborrowed-reserve path for an inter-meeting period. This residual borrowing is a discretionary aspect of policy, combining an initial borrowing assumption and inter-meeting judgmental adjustments to the nonborrowed-reserve path that are not made to the total reserve path.

These automatic and residual determinants of borrowing are not part of the policy record, but they can be approximated from published data (see figure 6). The automatic component is measured by the gap between actual total reserves and a total-reserve path estimated to have been consistent with the short-run money path chosen by the FOMC. The residual component can be approximated by the difference between total-adjustment borrowing and the automatic component. These *ex post* measures provide an empirical framework for reviewing policy implementation under the new procedure.

Several cautions must be noted before examining these measures of policy implementation. First, reconstruction of the 1980-81 experience with the reserve-targeting procedure in terms of automatic and discretionary components of total-adjustment borrowing obviously is not an exact replica of FOMC policy intentions.[6] In particular, the reconstruction of policy shown in figure 6 assumes that (1) M-1B (adjusted for NOW accounts in 1981) was the only FOMC target; (2) inter-meeting seasonally adjusted

6. For an account of monetary-policy implementation in 1980 that provides a fuller sense of the intentions, see "Monetary Policy and Open Market Operations in 1980," *Quarterly Review,* Federal Reserve Bank of New York, Summer 1981, pp. 56-75.

target-money paths grew at the constant rate implied by the directives, rather than at variable rates (reflecting short-run forecasts) that averaged to that constant rate; and (3) unintentional policy-implementation errors had a negligible influence on the actual levels of nonborrowed reserves.[7]

In addition, these measures are based on actual values of nonborrowed reserves (plus seasonal and special borrowing). Consequently, the calculated values of residual borrowing reflect not only the initial assumption of the FOMC about borrowing as well as judgmental adjustments to a nonborrowed-reserve path, but also "accepted" deviations of nonborrowed reserves from path.[8] Accepted slips between cup and lip, while useful for nice management of policy implementation in the short run, should be added to path levels of nonborrowed reserves when viewing the cumulative impact of policy implementation on money-market conditions and money growth. Therefore, given the simplifying assumptions, the measures of automatic versus discretionary aspects of the reserve-management experience provide a useful basis for analyzing the new procedure. The period examined begins with the February 1980 FOMC meeting (when M-1B replaced the old M-1 as a target) and extends until the July 1981 meeting.

Fluctuations in total-adjustment borrowing over the 17 months ending in early July 1981 roughly reflect fluctuations in the reserve gap, as the automatic feature of the reserve-targeting procedure would suggest (see figure 6). The automatic component of borrowing is self-explanatory, reflecting observed deviations of actual money growth from FOMC short-run targets (see figure 4). However, sizable movements in the estimated residual-borrowing (RB) component are also apparent. In particular, RB moved quite sharply from high values in the spring of 1980 to low values in the summer before returning to the relatively high values that persisted more or less until mid-1981. Even within these major intervals, RB sometimes moved up or down noticeably from one inter-meeting period to the next. From either perspective—i.e., comparing major intervals or comparing inter-meeting periods within those intervals—variations in RB suggest that discretionary adjustments to the amount of nonborrowed reserves available to depository institutions may play a significant role in the policy process.

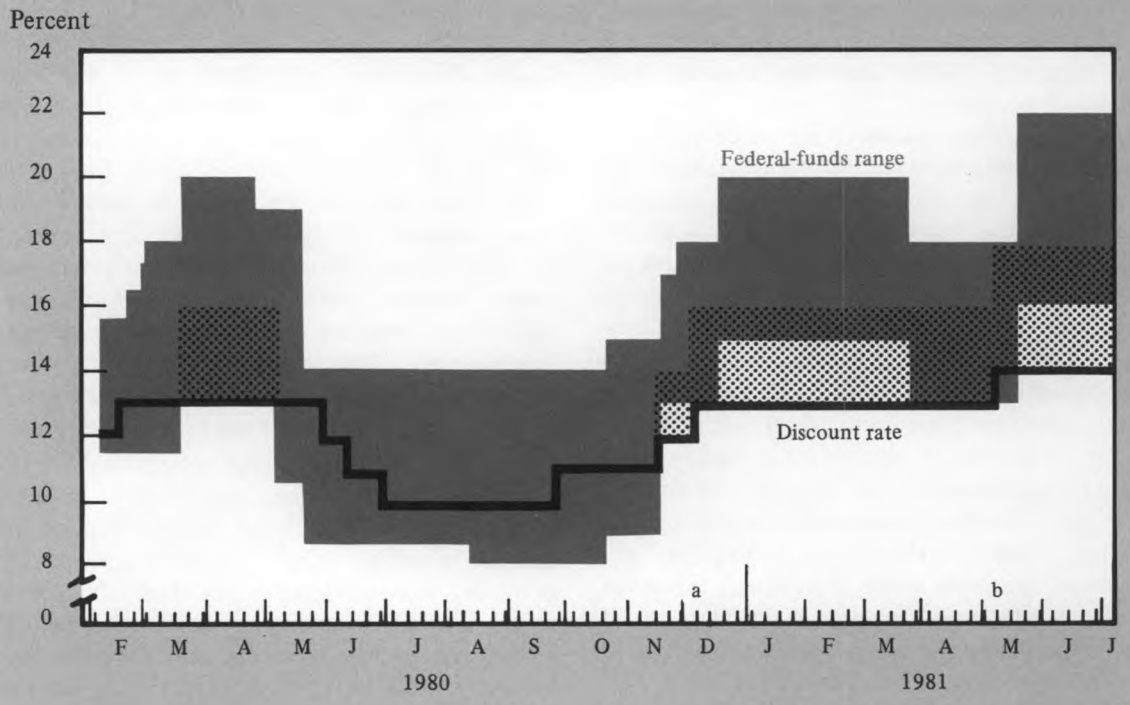
One way of looking at RB reflects its conceptual basis: that the funds rate expected to be associated with the joint values of RB and the discount rate must be related to desired movements in the quantity of money demanded. Thus, the level of RB would reflect the FOMC's short-run target relative to the recent trend rate of money growth. Targeting faster money growth in a stable or declining economy would require the lower interest rates that a reduction in RB would encourage. Similarly, targeting slower money growth would call for an increase in RB. Movements in RB over the three major intervals of the 17 months being reviewed fit this pattern. At its meetings in February, March, and April 1980, the FOMC sought 5 percent M-1B growth from the December 1979 base. At its May, July, and August 1980 meetings, after a precipitous decline in M-1B and economic activity, the FOMC sought more rapid short-run money growth, ranging from 7.5 percent to 8 percent from the April level to 9 percent from the June level. Then, after the level of M-1B had moved into, and at times above, the 1980 long-run target range and also in 1981, the FOMC again sought more moderate rates of growth, never more rapid than 6.5 percent.

The estimated values of RB mirror these major adjustments in the FOMC's money targets. In the first and third intervals, when money-growth targets were relatively low, RB averaged $2.2 billion and $1.3 billion, respectively. But, in the second interval, when the money-growth targets were relatively high, RB averaged only $0.2 billion. That the FOMC was

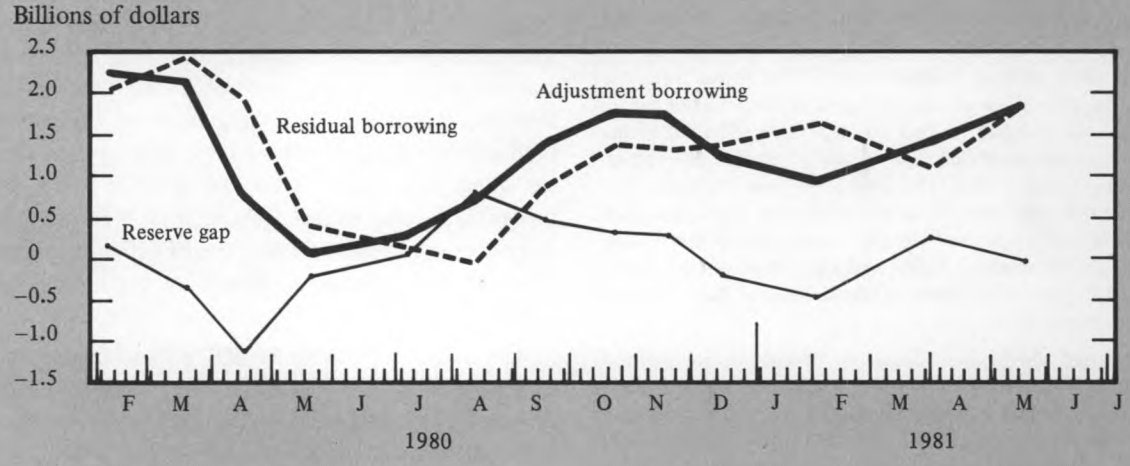
7. The stock of nonborrowed reserves can differ from the policy target because of unintentional implementation errors arising from inability to find purchasers or sellers of securities, or mis-estimates of reserve supply, on the last day of an inter-meeting period. The weekly average absolute value of this error was only about $63 million in 1980, less than two-tenths of 1 percent of the nonborrowed-reserve objective. See "Monetary Policy and Open Market Operations in 1980," *Quarterly Review,* Federal Reserve Bank of New York, Summer 1981, p. 68.

8. Accepted deviations represent "decisions to tolerate or even aim for reserve supplies either above or below average path values." For a discussion of the rationale for these market-smoothing events, see Fred J. Levin and Paul Meek, "Implementing the New Operating Procedures: The View from the Trading Desk," in Federal Reserve Staff Study—Volume I, Board of Governors of the Federal Reserve System, February 1981.

Fig. 6 Automatic and Residual Borrowing



NOTE: Shaded areas indicate periods when surcharge was in effect.
a. The December 5, 1980, FOMC provided trading desk leeway to pursue reserve objectives without being precisely constrained by the upper limits of the funds-rate range.
b. The May 6, 1981, FOMC recognized the rate might exceed the upper end of the range.



NOTE: Dollar values are averages of inter-meeting weeks, plotted at the beginning of the inter-meeting period.

Aggregate adjustment borrowing from Federal Reserve Banks is necessary under the lagged-accounting system as long as total-reserve needs of depository institutions exceed the volume of nonborrowed reserves supplied as a result of open-market operations of the trading desk.[1] Allocation of adjustment borrowing into automatic and residual components is based on the gap between actual total reserves and an estimate of the inter-meeting path value of total reserves.

The estimates of an inter-meeting total-reserve path (non-seasonally adjusted) used here were derived from the short-run money path (seasonally adjusted and, in 1981, NOW-account adjusted) specified in the published FOMC directive. Three steps were involved:

1. Weekly values of a seasonally adjusted money path (M^*) for an inter-meeting period were calculated from a path based on the center of the most recent month for which data were available to the FOMC and the center of the endpoint month of the growth-rate path specified in each FOMC directive.
2. Actual weekly non-seasonally adjusted levels of the currency component of money (C) were subtracted from a weekly non-seasonally adjusted money path using the published seasonal factors available at the time. This defined a non-seasonally adjusted deposit path ($M^* - C$).
3. Non-seasonally adjusted weekly deposit-path levels were multiplied by a reserve ratio to define weekly path values of total reserves (TR^*). The reserve ratio was the observed ratio of actual total reserves to the actual deposit component of money $\left(\frac{\hat{TR}}{\hat{M} - C}\right)$. Thus,

$$TR^* = (M^* - C)\left(\frac{\hat{TR}}{\hat{M} - C}\right).$$

The reserve gap (positive or negative) "borrowed" at the discount window, G, was measured by the difference between actual and path total reserves:

$$G = \hat{TR} - TR^* .$$

Residual borrowing, RB, was then measured by the difference between total-adjustment borrowing, B, and gap borrowing:

$$RB = B - G .$$

This measure of residual borrowing estimated from published data also reflects any unintentional policy implementation errors in hitting nonborrowed-reserve targets. The actual level of nonborrowed reserves can differ from the System target when: (1) the trading desk is unable to find buyers or sellers with whom to conduct open-market operations on the last Wednesday of an inter-meeting period; (2) there are errors in desk estimates of market factors affecting reserves on the last Wednesday of an inter-meeting period; (3) the target would require negative borrowing; and (4) final data differ from preliminary data because of interim revisions.

1. Adjustment borrowing excludes seasonal and extended credit.

aware of the interest-rate connection between RB and its money targets may be inferred from the concurrent adjustments in the discount rate and, with some lag, the range of the funds rate expected to be associated with those targets (see figure 6). Major movements of RB and the discount rate in 1980 reinforced each other in seeking first to stimulate and then to restrain money demand.

A second way of looking at RB focuses on short-run changes in the level of RB within each major interval as discretionary supplements to the automatic stabilizing feature of the reserve-targeting procedure. This casts a somewhat different light on 1980-81 experience, as changes in RB at times reinforced, and at other times dampened, the effects of automatic operation of the procedure on nonborrowed reserves.

In the first interval, covering 15 weeks of three inter-meeting periods from the February until the May meetings, the FOMC set a series of short-run money-growth paths that lay close to the midpoint of its long-run target range for 1980. The actual level of M-1B moved from above path early in the interval to a level far below path at the end. Estimated RB, while relatively high on the whole, declined over the interval, tending to reinforce the automatic procedure in reducing borrowing, adding to growth of nonborrowed reserves and easing money-market conditions.

A contrasting pattern emerged in the second interval, covering the 17 weeks of three inter-meeting periods from the May until the September 1980 meetings. The

FOMC set a series of short-run money-growth paths aiming at rapid money growth, consistent with restoring the level of M-1B to the midpoint of the long-run range before year-end. The actual level of M-1B, however, moved from below path initially to a level substantially above path so that adjustment borrowing increased automatically. While initially relatively low, estimated RB moved to even lower values over the interval, tending to dampen the effects of the automatic procedure by adding to growth of nonborrowed reserves and easing money-market conditions.

The third interval, covering forty-two weeks of seven inter-meeting periods, contained four relatively distinct phases. The inter-meeting periods from the September until the November 1980 FOMC meetings represented a transition. The money-growth path was reduced in two steps from the 9 percent path set in August to the 5 percent path set in October. Because the actual level of M-1B remained above these slower-growth paths, a relatively stable amount of reserve-gap borrowing was automatically maintained. At the same time, estimated RB increased dramatically, consistent with the reduction in short-run money-growth targets, and resulted in a substantial reduction in nonborrowed-reserve growth and a tightening of money-market conditions.

A marked shortfall of M-1B below path then developed during the 19 weeks from the November 1980 meeting until the March 1981 meeting. Estimated RB remained relatively constant so that the shortfall automatically produced a substantial reduction in adjustment borrowing that neither reinforced nor dampened the nonborrowed-reserve paths derived from the short-run money-growth paths. A marked excess of M-1B growth then developed during the seven weeks between the March and May 1981 FOMC meetings. The FOMC had agreed to accept money growth at or below a 5.5 percent path, but actual money growth was above path. Nevertheless, estimated RB declined somewhat, tending to dampen the automatic impact on borrowing of the April money bulge and adding to the nonborrowed-reserve objective.

Finally, in the seven weeks ending at the July 1981 FOMC meeting, short-run money-growth targets for M-1B were effectively reduced as the FOMC agreed to accept money growth below a 3 percent growth path from the high April M-1B level. M-1B declined from April to June, and, assuming that the FOMC accepted all of this decline, there was no gap between actual and target money growth. The marked increase in estimated RB thus represented a downward adjustment to the nonborrowed-reserve objective consistent with a reduced short-run money-growth path.

Experience since February 1980 thus demonstrates the several ways in which discretionary adjustments in RB and nonborrowed-reserve objectives have supplemented the automatic element of the reserve-targeting procedure. In three intervals—roughly during May 1980, September/October 1980, and May 1981—substantial changes in estimated RB, accompanied by adjustments in the discount rate, mirrored major adjustments in the FOMC's short-run money targets. Over the intervening portions of the whole period under review, the setting of RB sometimes reinforced (February to April 1980) and sometimes dampened (June to September 1980; April 1981) the impacts of automatic operation of the reserve-targeting procedure on nonborrowed reserves and money-market conditions. At other times (notably November 1980 to March 1981), the setting of RB was essentially unchanged, allowing variations in money growth from the target path to show through in adjustment borrowing and money-market conditions with no noticeable discretionary alteration of nonborrowed-reserve targets.

IV. Suggested Modifications of the New Procedure

Confusion and uncertainty are probably inevitable consequences of any change in policy implementation, and especially with the basic changes that occurred in October 1979. Much of the initial confusion has cleared up, however, as both the System and market observers have had an opportunity to watch the new procedure work under a variety of circumstances. Indeed, the experience of the first 17 months already has been used as the basis for suggestions to modify the procedure.

A theme running through many current discussions of policy implementation is how closely money growth should be expected to approach a short-run target path. It is difficult—perhaps impos-

sible—to conceive of a policy-implementation procedure that could maintain money on a target path at all times, at least as money is currently defined. Demands for money and total reserves are set in the marketplace; a policy procedure simply determines the quantity or the price of reserves.

The reserve-targeting procedure influences the funds-rate price of reserves in the short run by controlling growth of nonborrowed reserves. Price then operates through demands for money and total reserves to adjust quantity toward a target path in the longer run. Two aspects of this price-quantity sequence are noteworthy in the current procedure.

First, the procedure can maintain neither money nor total reserves on target path in the short run. In any reserve-maintenance week the System is effectively precluded from supplying reserve balances in any amount less than the total of required plus excess reserves demanded by depository institutions. If institutions cannot acquire sufficient reserves to meet reserve requirements within the reserve-maintenance period, they will be penalized or have reserve deficiencies carried over to the next week. Either mechanism amounts to a temporary adjustment of reserves, in effect expanding supply (albeit at a penalty price) or deferring demand. Similarly, if the System were to attempt to maintain reserves in excess of demand, institutions would repay discount borrowing or, if no borrowing existed, would simply accumulate excess reserves. This amounts to a temporary contraction of supply to meet demand. In the short space of the reserve-maintenance week, with lagged-reserve accounting and a lender-of-last-resort discount facility, the only mechanism by which the System can alter the effective supply of reserves is to have acted ahead of time to alter the quantity of money.

Second, while the procedure contains an automatic stabilizer, it is not an automatic pilot. That is, the procedure does not assure that price will adjust by an amount necessary to eliminate a deviation between actual and target growth of money and total reserves within an inter-meeting period or even a series of inter-meeting periods. The automatic component of the procedure promises a prompt movement of borrowing and the funds rate in the right direction, but not necessarily by the right amount. Successful management of the discount rate and residual borrowing is required to achieve target-growth rates.

Suggestions for modifications in the reserve-targeting procedure fall into two major categories. Some would tighten the automatic connection between a deviation of money from its target path and adjustments to the price of reserves, with the expectation that demand for total reserves would be brought back to target with more certainty. Others would tighten Federal Reserve direct control of total-reserve supply, forcing more immediate adjustment in the price of reserves to prevent deviation of total-reserve demand from target.

Examples of the first approach include more deliberate manipulation of nonborrowed-reserve targets and the discount rate. Nonborrowed reserves could be adjusted to manage the rate spread when money departs from target path.[9] Adjustments to residual borrowing that reinforced or dampened rate effects of a reserve gap have been a common feature of the reserve-targeting experience. These adjustments to the nonborrowed-reserve objective might be institutionalized by explicit operating rules, for example, linking the level of residual borrowing to the duration of a reserve gap or to a particular rate spread relative to the reserve gap. The discount rate also could be linked to the size and duration of a reserve gap. One suggestion is to expand the surcharge concept by specifying an explicit credit line for each depository institution, but with higher surcharges for larger drawings on the credit line. Variations in adjustment borrowing automatically produced by deviations from target-money growth would be expected to translate into a rate spread roughly determined by the surcharge schedule. The steeper the scheduled escalation of the surcharge with respect to drawings on the line, the more pronounced would be the reaction of market rates to off-target money growth, and, therefore, the more quickly money demand might move back toward target.

9. Experience suggests that the aggregate weekly relationship of the rate spread to borrowing has been considerably less predictable since October 1979 than was the relationship of borrowing to the rate spread prior to October 1979. See Peter Keir, "Impact of Discount Policy Procedures on the Effectiveness of Reserve Targeting," in Federal Reserve Staff Study—Volume I, Board of Governors of the Federal Reserve System, February 1981.

Examples of the other approach include suggestions to adopt a more contemporaneous reserve-accounting system and a penalty discount rate. The current two-week lag precludes depository institutions from adjusting their reservable liabilities and reserve requirements to conform to the available supply of reserves. Consequently, they must borrow from the discount window whatever portion of total-reserve needs are not forthcoming as nonborrowed reserves. Contemporaneous reserve accounting would make it possible for depository institutions to contract or expand total assets and monetary liabilities to match the volume of reserves being supplied by the Federal Reserve.[10] In addition, if the discount rate were always at a penalty level above market rates, the desk could expect to be more successful in hitting a total-reserve target from week-to-week, because discount borrowing would usually be a less attractive alternative than scaling down assets and liabilities when reserves were scarce.[11]

10. Contemporaneous reserve accounting would probably not hasten the adjustment by a full two weeks, because the information lag in setting the weekly nonborrowed-reserve objective is not that long with lagged-reserve accounting. Projections of deposit growth are used early in an inter-meeting period to derive a weekly nonborrowed-reserve path. In a four-week period, for example, paths derived on Friday of the first week are based on the actual currency and deposit data published that evening for the week ending nine days earlier, plus preliminary data received for the week ending two days earlier, plus projections for the next two weeks. By Friday of the third week of a four-week inter-meeting period, no projections are necessary: reserve paths are derived from three week's published data plus one week's preliminary data. In addition, judgmental adjustments to the nonborrowed path may be made in the last week of a period to incorporate information about money growth that will determine reserve needs in the first week of the next period. See Peter Keir, "Impact of Discount Policy Procedures on the Effectiveness of Reserve Targeting," p. 14; and Fred J. Levin and Paul Meek, "Implementing the New Operating Procedures: The View from the Trading Desk," p. 7.

11. Discount borrowing still could prevent short-run achievement of a total-reserve target under what is called contemporaneous reserve accounting. Proposals envision a one- or two-day lag between reserve computation and reserve maintenance to allow time for computation and reporting (see Federal Reserve press release, June 4, 1980). Total-reserve demand would still be predetermined on the last one or two days of the maintenance period, with deviations of total-reserve demand from nonborrowed supply requiring accommodation at the discount window.

V. Conclusion

Where there's a will to achieve money-growth targets, there's a way; indeed, there are innumerable ways. For almost a decade the FOMC relied on daily management of the federal-funds rate, accommodating most short-term variations in money growth above or below its money target and only gradually moving the funds rate when off-target growth seemed likely to persist. Whether the fault of will or way, money-growth targets were missed persistently in 1977 and 1978.

At another extreme, the FOMC might adopt true contemporaneous reserve accounting, cease lending for reserve-adjustment purposes (or set the discount rate at a penalty level for effective elimination of borrowed reserves), and simply feed nonborrowed reserves into the financial system at a steady predetermined rate. This would force the market to accommodate (by foresight in accumulating excess reserves) or eliminate (by variations in interest rates) all potential deviations of money above or below a path consistent with the target supply of reserves.

The actual procedure adopted in October 1979 lies between these two extremes. The nonborrowed-reserve path accommodates expected seasonal and some offsetting week-to-week variations in the quantity of money, but otherwise is designed to accommodate off-target money growth only through the discount window with consequent repercussions on the federal-funds rate and other rates. Persistent deviations from target path automatically cause interest-rate movements that tend to counteract the deviations, reinforced or dampened by discretionary adjustments in the residual-borrowing assumption made in setting and resetting the nonborrowed-reserve target path.

Will this way of controlling money growth work better? The experience of 1980 suggests that it can. Despite enormous unpredicted movements in money demand apparently caused by credit controls, and accompanied by substantial adjustments to the residual-borrowing assumption and nonborrowed-reserve paths, and after appropriate adjustments to reflect unexpected growth of new interest-bearing transaction accounts, the Humphrey-Hawkins M-1B target range for 1980 was exceeded by only 0.25 per-

cent. Results are, of course, not final for 1981. As of summer, the desired low end of the target range seemed achievable, although apparent shifts to non-M-1B transaction balances made even that modest target questionable. Certainly 1980 and 1981 experience have demonstrated the increasing willingness of the FOMC to tolerate the automatic stabilizing feature of the reserve-targeting procedure and substantially greater interest-rate variations than ever experienced under the previous procedure.

Finally, this review of reserve targeting should be placed in a larger context. The new procedure is simply a central-bank operating technique for monetary targeting. Discussion and debate about this technique should not be allowed to obscure more fundamental questions about what an appropriate monetary growth rate is, what monetary or other aggregate (s) to target, and whether monetary targeting itself is an appropriate central-banking control device, especially in an era of far-reaching financial market innovation.

Mortgage Redlining: Some New Evidence

by Robert B. Avery and Thomas M. Buynak

Several laws have been passed in the last decade to outlaw discrimination in credit markets and to correct for the perceived failure of the market to distribute credit equitably. At the federal level, the most notable of these acts are the Fair Housing Act of 1968, the Equal Credit Opportunity Act of 1974 (amended in 1976), the Home Mortgage Disclosure Act of 1977, and the Community Reinvestment Act of 1977. Despite this legislation, the regulatory and judicial bodies are still struggling to agree on a precise definition of discrimination and on how it can be prevented. Particular concern has focused on housing and mortgage credit because of the sheer size of these markets. Debate has centered on allegations that financial institutions, particularly in urban areas, have severely limited their mortgage-lending activity in certain poor and/or black neighborhoods, a practice commonly called *redlining*.

One factor that has hampered attempts to establish definitive regulatory procedures regarding discrimination and redlining is the absence of a clear-cut understanding of current lending practices and patterns. Congress recognized the need for empirical study when it passed the Home Mortgage Disclosure Act (HMDA) and the Community Reinvestment Act (CRA). The HMDA requires commercial banks, mutual savings banks, and savings and loan associations in urban areas to disclose data publicly on their mortgage and home-improvement lending by census tract. The CRA requires financial institutions to demonstrate that they adequately serve the credit needs of their communities and provides the opportunity for protestants to challenge such claims (see Buynak 1981 and Canner and Cleaver 1980).

This paper utilizes HMDA data to investigate a number of issues underlying the redlining debate. Although the study focuses on Cleveland, Ohio, the site of a number of recent CRA protests, the findings and methodology may have relevance for other similar areas. The remainder of this paper reports the results of an empirical investigation of mortgage lending in Cleveland from 1977 to 1979. The empirical relationship between mortgage lending and neighborhood racial characteristics is estimated, controlling for demand and risk factors. Although similar in design to several preceding studies, this paper differs from most because of its particularly rich data set. The data include virtually all mortgage loans made during the three-year period in the central county of the Cleveland SMSA, an area characterized by substantial racial and economic heterogeneity. As a proxy for neighborhood credit needs, all residential real-estate title transfers made during the same period were collected and aggregated by census tract (as were the mortgage loans). In addition, court foreclosure filings were collected by tract to control more explicitly for risk factors. The data were utilized to estimate several sets of cross-sectional and inter-temporal regressions relating the mortgage lending of banks, savings and loan associations, and mortgage bankers to neighborhood (tract) racial and demographic factors controlling for measures of credit need and risk. The results are presented in Section III, along with a detailed discussion of the data and methodology. These are preceded by a review of other studies in Section I and a discussion of the empirical setting in Section II. Section IV summarizes and interprets the findings.

Robert Avery is an assistant professor of economics at Carnegie-Mellon University and a consultant with the Federal Reserve Bank of Cleveland; Thomas Buynak is an economic analyst with the Federal Reserve Bank of Cleveland.

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I. Why Redlining?

There are a number of reasons to explain a correlation between neighborhood characteristics, particularly racial, and the type and amount of mortgage lending. It is not the purpose of this paper to argue the positive and negative aspects of these theories or to speculate as to which are the most plausible. However, it may be useful to discuss some of the prevalent theories and to review briefly previous empirical findings. Throughout this paper the word *redlining* denotes a correlation between the racial composition of a neighborhood and the type and amount of mortgage lending resulting from differential lending policies. This definition makes no statement about the explicit lines of causality or legality and thus may differ from the usage of others.

Theories of Redlining

Several arguments have been advanced to explain a possible correlation between neighborhood racial composition and mortgage lending. One argument is that there are lenders who treat borrowers differently, based on factors other than cost or risk. Two sources are suggested for such discrimination. Lenders could practice non-economic or "irrational" discrimination; or, as Barth, Cordes, and Yezer (1979) argue, they simply could dislike lending in certain neighborhoods and thus treat certain borrowers differently. Alternatively, lenders acting either individually or collusively could engage in classical price discrimination. *Price discrimination* occurs when borrowers are charged different prices based on demand rather than cost (or risk) factors. If borrowers have different elasticities of demand, a monopolist lender could earn higher profits if he could charge different prices. If lenders were to discriminate by setting higher credit standards and/or prices for blacks (as individuals) because they think that blacks have less elastic demand for credit, fewer loans to blacks would result (see Masulis 1981). Such price discrimination would have the appearance of redlining—either in loan quantities or mortgage terms—and would be most pronounced in all-black neighborhoods.

Guttentag and Wachter (1980) argue that the discrimination hypotheses are not likely to be appropriate. They assert that the large number of lenders and competitive market conditions make it unlikely that discriminatory conditions would prevail in general, although they might apply to individual lenders. Similarly, they argue that the differential demand elasticities and collusive behavior required for classical price discrimination are unlikely to be present in banking markets.

A second set of explanations for an expected correlation between neighborhood characteristics and mortgage-lending patterns assumes that lenders do differentiate among borrowers, but only on the basis of cost or risk factors. If, for example, low-income applicants were more likely to be black and also were perceived by lenders to be more risky, one would expect a statistical correlation between loan availability and race, even in the absence of discriminatory behavior on the part of lenders. Similarly, borrower-loan demand may be related to other factors, such as income or family stability, that also are correlated with race (see Canner 1979); thus, in the aggregate blacks may appear to demand fewer loans because, on average, they are poorer, not because they are charged different prices. This might also affect the instruments used in lending. Low-income borrowers who purchase cheaper housing, for example, may be more likely to receive home-improvement or installment-loan financing because of the high fixed transactions costs involved in mortgage loans. If blacks were more likely to purchase lower-priced homes, one might draw a correlation between race and the type of lending. In any of these cases, one would expect that neighborhood characteristics, as aggregates of individual characteristics, would also be correlated with loan availability. Guttentag and Wachter (1980) point out that lenders, in recognizing this statistical correlation, may use an applicant's neighborhood as a proxy for risk variables, which for cost purposes are not collected for individual borrowers. These arguments suggest that neighborhood racial characteristics may be used as proxies for individual applicant factors, such as income, associated with loan risk or demand. Thus, when these other factors are properly controlled, the statistical correlation between neighborhood race and loan availability should disappear. If this were the case, then this situation would not constitute redlining as earlier defined.

Although not generally cited in the redlining literature, additional theories argue that there may

be a statistical correlation between the racial composition of a neighborhood and credit availability, even if one properly controls for all individual characteristics. Bailey (1959), Mills (1972), and many others have developed urban-housing "prejudice" models based on the assumption that whites would be willing to pay higher prices to live in all-white neighborhoods rather than live in neighborhoods with blacks. These models generally imply perfectly segregated neighborhoods separated by what Bailey termed a "black border." The willingness of some whites to pay for their prejudice implies that per-unit housing prices would be lower in all-black neighborhoods and in white areas nearest to the black border. Mieszkowski (1979), among others, concludes that these models imply that middle-income blacks would devote a smaller portion of their income to housing. Black borrowers, therefore, should be more attractive to lenders because they would be better risks than middle-income white borrowers.

Most of the applications of the Bailey-Mills model assume a constant proportion of whites to blacks. Very different conclusions about the relative attractiveness of black and white borrowers can be derived by relaxing this assumption. The Bailey-Mills model implies that the relative price of black to white housing is a decreasing function of the proportion of the population that is black. Thus, if the assumption is made that the percentage of black population is rising, this would imply that the relative price of black to white housing would fall. Transition areas near the black border also would have lower relative prices. The relative price of black housing would fall even if the growth of the black population (and the change in prices) were fully anticipated by home buyers.

The implications of this version of the prejudice model are the opposite of those of the simpler models. Since relative home prices in black neighborhoods (even those already 100 percent black) theoretically would fall as the percentage of blacks in the area rises, the value of black houses as collateral would be lower; lenders thus would be willing to lend less. Similarly, relative housing prices in all-white areas far removed from the black border would be expected to rise, offering more attractive lending collateral. In effect, the racial composition of a neighborhood becomes a proxy for expected future price changes and hence for the value of loan collateral.

Previous Empirical Work

Each of the redlining theories has somewhat different empirical implications. The discrimination theories suggest that the number of blacks in a neighborhood should determine the lending policies, even when income and other demographic factors are taken into account. Although gross correlations may exist between race and the volume of mortgage credit, theories based on risk and demand factors imply that this relationship should disappear when other demographics are considered. Finally, some versions of the Bailey-Mills model suggest that it is the change in racial composition, rather than levels, that is relevant—that lending in integrated and all-black neighborhoods would be relatively more attractive in stable areas than in areas where the racial composition is changing.

Although not necessarily designed to discriminate among these hypotheses, there have been a number of empirical redlining studies by both community action groups and researchers (see Benston 1979, 1981 and King 1980). These studies can be divided roughly into two categories: one type utilizes HMDA and census data and deals with aggregate mortgage-lending patterns across neighborhoods, while the second focuses on individual borrowers and differences in specific mortgage terms (e.g., downpayments, interest rates). Nearly 25 cities nationwide have been examined using one or both of these approaches.[1] Since this study builds heavily on these earlier works, a brief discussion of some of the key findings from representative cases may prove useful.

The objective of most of the aggregate HMDA-based studies (and this one as well) has been to estimate not only the gross relationship between race and mortgage credit, but to identify the particular effects stemming from supply, or the actions of the lender. To do this properly requires the specification of both supply and demand equations and a meaningful method of separating their effects. Unfortunately,

1. Areas that have been examined include Boston, New York City, Syracuse, Rochester, Buffalo, Pittsburgh, Toledo, Flint (Mich.), Chicago, Louisville, Miami, San Antonio, Los Angeles, Oakland, and Sacramento.

it is virtually impossible to come up with variables that would affect supply and not demand. For this reason virtually all previous studies (and this one as well) have relied on reduced-form analysis—i.e., regressing measures of mortgage-loan activity against race and all other variables thought to be related to either supply or demand. While unable to provide specific information on supply effects, these equations can show the relationship between race and the type and quantity of mortgage lending while controlling for income, housing stock, and other demographics. This information still may be useful for discriminating among redlining hypotheses; however, since the equations, at best, only crudely identify supply factors, they must be carefully interpreted before drawing any policy conclusions.

The critical differentiating factor among aggregate HMDA-based studies is the quality of the data used to control for factors other than race. One study that stands out was done by Hutchinson, Ostas, and Reed (1977 and Ostas, Reed, and Hutchinson 1979), who examined a subset of Toledo, Ohio, savings and loan associations. They found that racial composition was not correlated with the total number of loans extended within a neighborhood, but it was related to the ratio of conventional to government-insured loans. They concluded that lenders substitute riskless government contracts in those areas perceived to have the greatest risk. Canner (1979) conducted a similar but more comprehensive analysis of mortgage lending in Boston, Massachusetts. Using various indexes of mortgage-loan activity (e.g., the number of conventional loans to total transactions in a census tract), he found that, other things being equal, the racial composition of Boston neighborhoods affected the number of loans issued by institutional lenders. However, he also found that nonbanking businesses and other private individual lenders filled some of the "mortgage gap" in all-black (although not integrated) neighborhoods. These loans were often made with nontraditional instruments such as land-installment contracts.

Schafer's (1978, chap. 5) comprehensive examination of New York City differs in that it explicitly compares two different types of neighborhoods. Neighborhoods were separated into alleged redlined and non-redlined areas, and separate models were estimated for each data set. The coefficients estimated from the non-redlined data were multiplied by the values of the independent variables of the redlined neighborhoods generating predicted funding for the alleged redlined areas. A comparison of the predicted values with the actual loans revealed that fewer loans were made available than predicted in some redlined neighborhoods.

There have been fewer studies that have used individual borrowers as the unit of observation, primarily because of data limitations.[2] One of the better studies is Benston, Horsky, and Weingartner's (1978) examination of three years of individual mortgage terms in two Rochester, New York, neighborhoods. One area was an allegedly redlined (by lenders) area, and the other served as a control (non-redlined) area. After adjusting for housing characteristics, such as age and selling price, they found that the mortgage terms in the two areas were not significantly different. Schafer's (1978, chap. 6) similar study of New York City contains mixed results, but some evidence was found that neighborhood characteristics affect loan terms. King (1980, sect. 6) analyzed mortgage applications of federally insured savings and loan associations for evidence of discrimination related to age, race, sex, marital status, and property location in the SMSAs of Miami, Florida; San Antonio, Texas; and Toledo, Ohio. The results of his study, similar to those of Benston, Horsky, and Weingartner, did not support the hypothesis that lending terms were related to discriminatory factors after adjusting for neighborhood and borrower characteristics.

II. Empirical Setting

The empirical analysis focuses on Cuyahoga County, which is the central county of the Cleveland SMSA. The county encompasses Cleveland and 54 suburban communities divided into 357 census tracts, 335 of which are used in the study.[3] This area was

2. Lending institutions in the states of Massachusetts, New York, and California are required to disclose data on individual loan terms along with other borrower neighborhood and property information.

3. Twenty-two tracts were excluded, because they had a 1970 population of less than 300. Almost all deleted tracts were in Cleveland's sparsely inhabited downtown and industrial flats area.

Table 1 Demographic Characteristics of Cleveland

	Total population, thousands		Black population as a percent of total population		Median family income, dollars	Housing stock, 1-4 family, thousands	Percent of total houses built prior to 1939	Owner-occupancy rate as percent of 1-4 family units
	1970	1980	1970	1980				
Cuyahoga County	1,721	1,498	19.1	22.7	11,309	454	48.9	51.7
City of Cleveland	751	574	38.3	43.8	9,107	206	73.3	40.9
Suburbs	970	924	4.2	9.7	14,643	248	28.4	68.0

NOTE: Unless otherwise noted, the data are for 1970; only 1980 population demographic data have been released to date.

Table 2 Distribution of 1977-79 Housing-Related Loans in Cleveland

Financial institutions	Number of institutions, 1979	Conventional mortgage loans, 1977-79		FHA mortgage loans, 1977-79		Total mortgage loans, 1977-79		Home-improvement loans, 1977-79	
		Number	Average	Number	Average	Number	Average	Number	Average
Commercial banks	10	11,582	$42,169	108	$33,703	11,690	$42,091	38,925	$4,828
Savings and loans	27	56,065	37,034	1,625	38,235	57,690	37,068	5,662	7,084
Mortgage bankers[a]	29	–	–	5,425	32,019	5,425	32,019	–	–
All financial institutions	66	67,647	37,913	7,158	33,456	74,805	37,487	44,587	5,114

a. The few conventional loans extended by mortgage bankers do not fall under the reporting requirements of HMDA and, hence, are not included in these figures.

selected for two reasons. First, it is of particular concern to the Fourth Federal Reserve District, as the majority of CRA protests received in this district involve Cleveland-based institutions. Second, it offers a particularly well-suited environment to investigate redlining. The county is a good approximation of the service area of the 37 banks and savings and loan associations included in the study.[4] As a group, these banks and savings and loans make over 80 percent of their mortgage loans within the county. The county also has a large, growing black population that is for the most part segregated. Since most of the SMSA's commuting suburbs are contained within the county, the data set offers the potential to separate the effects of racial patterns from those generated by income or other neighborhood characteristics.

4. During the period of study, Ohio was classified as a limited branch state. Commercial banks were permitted to branch only within the county in which they were headquartered, and savings and loan associations were geographically restricted to branching within a 100-mile radius of their home offices.

The population of the county has declined steadily over the past decade. As shown in table 1, most of the population loss has been from the city. Whereas the county's white population has fallen since 1970, its black population has risen slightly. Although the percentage of blacks within the city has risen, there has been a decline in the actual number of black city residents. The increase in the county's black population has occurred in the suburbs, where the percentage of blacks has more than doubled in the past 10 years.

There are a number of significant differences between the city and its surrounding suburbs. The city was almost completely developed by the 1930s, as nearly 80 percent of its housing stock was built prior to 1939. According to the Department of Housing and Urban Development (HUD) definition, almost 60 percent of the city's 204 census tracts are classified as low-to-moderate income neighborhoods versus only 4 percent of the county's 153 suburban tracts.

Both the city and the suburbs have similar racial patterns (see figure 1). A clear east-west racial split

exists; the city's black population is concentrated in the eastern portion, and most suburban blacks reside in the northeastern and southeastern suburbs. For the county as a whole, 80 percent of the area's white population lives in neighborhoods that are less than 10 percent black; 73 percent of the county's black population lives in neighborhoods that are greater than 90 percent black.

Ten commercial banks and 27 savings and loan associations were headquartered in the county from 1977 through 1979. Twelve of the 37 institutions (six of each lender type) control over $900 million in assets. Virtually all of the roughly 75,000 home mortgages and approximately 45,000 home-improvement loans issued in the county during the three-year period under study were extended by these institutions or one of 29 mortgage bankers. As shown in table 2, savings and loans accounted for the majority of mortgages extended over the three-year period, while commercial banks extended most of the home-improvement loans. The average value of mortgages extended by banks was slightly higher than that for savings and loans and significantly higher than that for mortgage bankers. For home-improvement loans, the average value extended by savings and loans was one and one-half times that extended by banks. Federally insured Federal Housing Act/Veterans' Administration (FHA/VA) loans represented 10 percent of the total number of county-wide mortgage loans over the 1977-79 period, with mortgage bankers accounting for over 75 percent of this total.

III. Empirical Results

This study addresses the empirical issues related to redlining by using two different sets of multivariate regressions. One set relates the levels of six different measures of loan activity to the racial composition of Cleveland neighborhoods (tracts), controlling for income, risk, and other nonracial neighborhood characteristics. The second set relates the change in the same six dependent variables to the change and lagged changes in the racial composition of neighborhoods. Each of these regressions has a similar form, relating different dependent variables to a common set of independent variables. Because the quality of data has been a controversial topic in the redlining literature (see Benston 1979, 1981), the preparation of data is discussed in greater detail than might normally be the case. The actual variables used are listed in table 3, along with variable means and standard deviations for the total sample and seven subsamples.

Dependent Variables

The dependent variables are based primarily on loan data reported under the Home Mortgage Disclosure Act by all Cuyahoga County banks and savings and loan associations for the years 1977-79. Total mortgage and home-improvement loans for the three-year period were aggregated by census tract separately for reporting banks and savings and loans. FHA and VA data also were used to calculate federally insured mortgage loans made by mortgage bankers and also were aggregated by tract for the same period.[5] Although these figures exclude loans made by out-of-county financial institutions, conventional mortgage banker loans, and loans by private individuals, they appear to account for almost all Cuyahoga County mortgages made during this period.

Taken by themselves, raw figures on mortgage lending activity would be misleading indicators of loan availability because of differences in neighborhood turnover rates. As a crude measure of potential "loan needs," the total number of housing deed transfers was aggregated by tract for the three-year period using data collected from the Cuyahoga County Auditor's office. Measures of loan activity (number of loans) were then deflated by deed transfers and multiplied by 100 for each tract. The resulting variables, which formed the actual dependent variables for this study, could be thought of as percentages of the transfers in each tract financed by different institutions. Variables were constructed to reflect mortgage loans issued by (1) banks, (2) savings and loans, (3) mortgage bankers, (4) total mortgage loans, and (5) total home-improvement loans. A sixth dependent variable was constructed by deflating the total dollar value of mortgage and home-improvement loans by the total dollar value of owner-occupied one-to-four unit housing stock as measured in the 1970 census (1977 dollars) and

5. Unfortunately, only the city location of mortgage banker VA loans was available. The distribution of the similar non-subsidized (Section 203) FHA mortgage banker loans, therefore, was used to assign VA loans randomly to census tracts within cities.

multiplying by 100. This variable is a crude measure of the percentage of the value of each neighborhood financed by equity lending each year.

If "loan needs" were accurately measured by the deed-transfer variable, then the first five dependent variables would be constrained to lie between 0 percent and 100 percent. Unfortunately, in many neighborhoods the number of loans exceeded the number of transfers because of widespread issuance of second mortgages. Similarly, although efforts were made to eliminate them, some transfers that generally do not require financing, such as those resulting from divorce or death, still remain in the data. For these reasons, the dependent variables are only approximate measures of the percentage of "loan needs" actually financed.

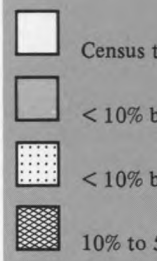
Independent Variables

Independent variables were drawn primarily from the 1970 U.S. Census of Population and Housing. Three variables were used to characterize neighborhood income: (1) median yearly family income; (2) percentage of tract families with income below the official poverty line ($3,743 for a family of four in 1969); and (3) percentage of employed persons within the tract who were professionals or managers. Four census variables were selected to control for neighborhood housing characteristics: (1) median value of owner-occupied one-to-four unit houses; (2) real percentage change in median value of owner-occupied housing from 1970 to 1977;[6] (3) percentage of owner-occupied housing built before 1939; and (4) percentage of one-to-four unit structures that were owner-occupied. Both the income and housing values were expressed in 1977 dollars for comparability with mortgage figures. One particular concern with these variables is that, unlike other variables in the study, they were measured as of 1970 instead of 1977-79. Thus, particularly in changing neighborhoods, they may be inaccurate measures of 1977 conditions.

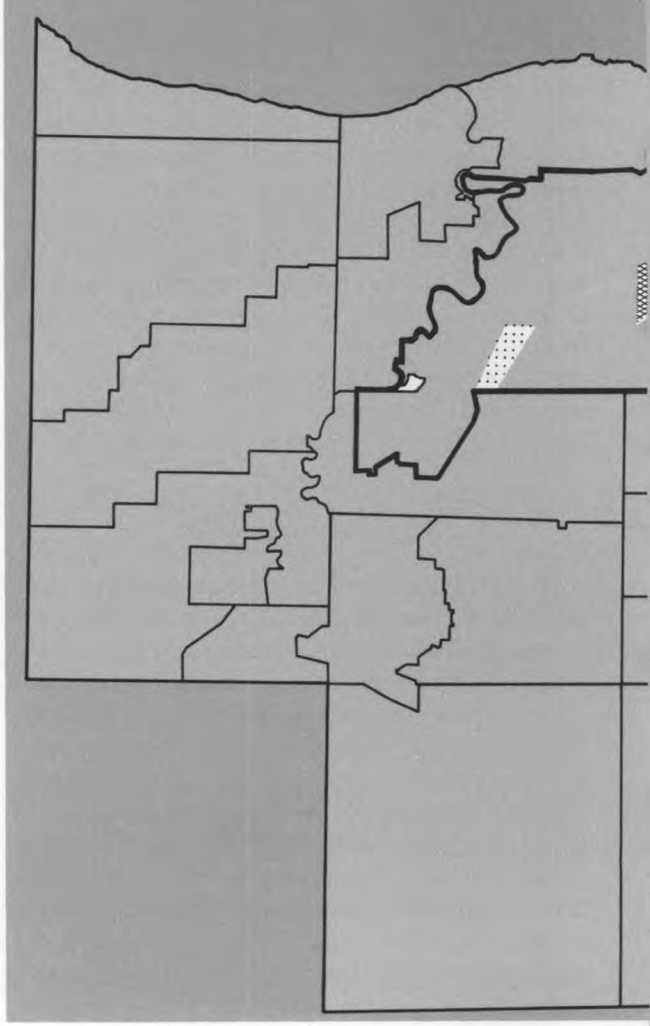
An eighth independent variable was selected to control for risk differences across neighborhoods. County records of foreclosure filings were collected for the years 1973-79 and aggregated by the census tract of the cited property. This variable then was

6. The 1977 value was estimated from the median price of houses sold in each tract in 1977.

Fig. 1 Racial Composition of Cuyahoga County[a]



a. The heavy black border designates the city of Cleveland.
b. The 1970 data are from U.S. Census of Population and Housing; 1977 data are from the Cuyahoga Plan of Ohio, Inc.



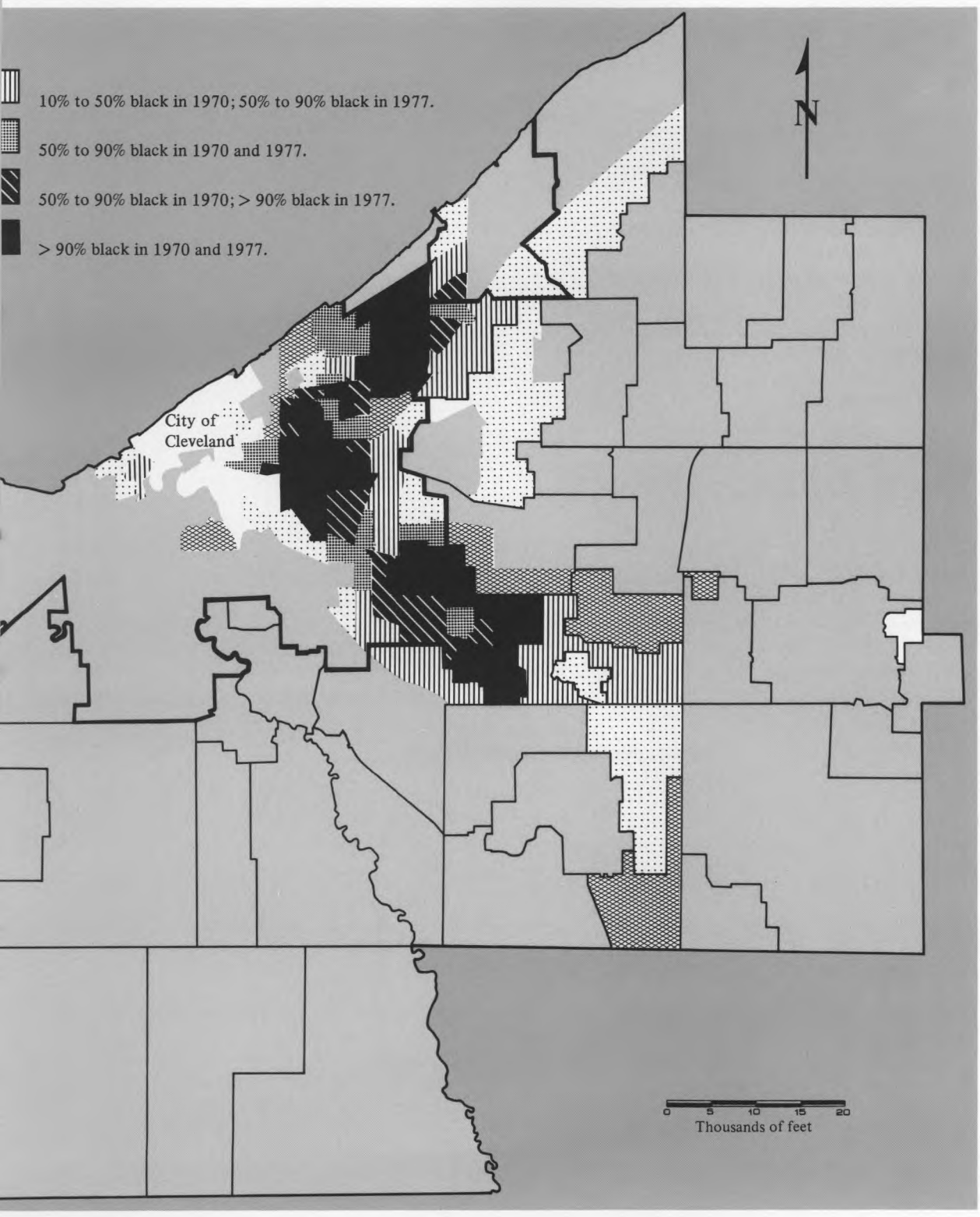


Table 3 Sample Means of Variables
Standard deviations in parentheses

Variables	Symbol	Total sample	Tracts sorted by percent black in 1970 and 1977 (A)	(B)	(C)	(D)	(E)	(F)	(G)
Number of tracts	TRACTS[a]	335	201	29	13	19	14	17	42
Bank mortgage loans to transfers, percent	TOTBNK[a]	14.1 (13.2)	17.7 (14.1)	16.2 (9.7)	14.4 (13.2)	6.7 (4.7)	8.4 (12.4)	3.2 (3.2)	5.2 (5.8)
S&L mortgage loans to transfers, percent	TOTS&L[a]	71.4 (36.2)	89.1 (27.3)	70.2 (27.8)	67.4 (51.8)	44.6 (19.3)	29.6 (20.8)	33.0 (19.1)	30.6 (22.7)
Nonbank mortgage loans to transfers, percent	TOTOTH[a]	11.3 (18.6)	5.5 (10.1)	8.4 (10.6)	8.4 (18.0)	27.7 (21.0)	18.4 (18.7)	38.5 (40.5)	21.4 (21.8)
Total mortgage loans to transfers, percent	TOTALL[a]	96.9 (42.1)	112.3 (32.4)	94.7 (35.9)	90.1 (62.1)	79.1 (26.3)	56.5 (35.5)	74.7 (56.4)	57.2 (40.7)
Total home-improvement loans to transfers, percent	TOTHI[a]	93.6 (73.8)	57.4 (20.3)	63.5 (23.7)	103.8 (72.7)	116.3 (38.2)	161.6 (83.7)	177.2 (85.8)	218.0 (83.6)
Total loan dollars to total value owner-occupied housing, percent	TOTLO$[a]	31.7 (66.6)	34.5 (80.2)	35.7 (43.5)	31.1 (20.5)	53.5 (76.5)	20.4 (13.3)	18.2 (8.0)	15.0 (5.8)
Percent black, 1977	%BLK77[b]	28.9 (38.7)	1.9 (2.1)	22.2 (9.5)	33.2 (10.2)	73.4 (11.3)	83.6 (7.0)	93.2 (1.6)	97.1 (2.6)
Change in black, 1970-77, percent	CNG%BL[b]	6.3 (12.1)	1.5 (2.0)	19.1 (9.5)	4.5 (11.3)	42.4 (11.8)	12.4 (14.9)	12.5 (8.6)	0.1 (2.1)
1970 median family income, thousands of 1977 dollars	MEDINC[c]	18.7 (7.2)	21.1 (7.2)	19.3 (5.7)	17.7 (6.8)	16.0 (3.8)	12.7 (3.6)	13.5 (3.7)	12.2 (4.6)
1970 median value owner-occupied house, thousands of 1977 dollars	MEDVAL[c]	33.7 (15.1)	38.4 (15.9)	33.4 (13.5)	30.7 (14.2)	29.5 (10.1)	21.9 (6.1)	22.8 (5.5)	22.7 (6.8)
Change in median real value of house, 1970-77, percent	CNG%VA[a]	−1.0 (40.1)	12.0 (34.3)	−3.1 (18.8)	−12.1 (30.3)	−0.01 (64.6)	−16.1 (63.8)	−32.9 (20.4)	−40.8 (24.5)
1970 owner-occupied housing built before 1939, percent	%<1939[c]	58.6 (33.3)	52.4 (34.4)	60.9 (35.2)	52.3 (35.7)	69.3 (28.1)	74.3 (21.3)	73.5 (21.9)	72.6 (26.8)
1970 families below poverty income, percent	%<POV[c]	9.9 (11.1)	5.0 (4.3)	7.6 (6.8)	11.8 (12.0)	11.7 (8.6)	22.9 (13.4)	18.6 (11.4)	25.7 (15.0)
1970 workers employed as professionals/managers, percent	%PROF[c]	20.2 (14.6)	23.1 (14.7)	26.3 (16.4)	22.5 (18.4)	22.7 (10.2)	10.3 (5.0)	8.1 (4.1)	8.4 (4.9)
1970 owner-occupied structures, percent	%OWNOC[c]	54.0 (25.4)	62.7 (21.7)	52.1 (24.4)	43.8 (26.7)	37.6 (22.2)	33.3 (22.0)	43.1 (28.1)	35.6 (24.6)
1973-79 foreclosure actions per owner-occupied house, percent	CTYFC[d]	7.8 (13.4)	2.5 (2.8)	5.2 (3.9)	8.6 (6.1)	25.9 (11.9)	24.3 (24.7)	27.3 (36.2)	12.9 (8.2)
1970 population, thousands	POPULA[c]	5.1 (3.5)	5.7 (4.0)	4.1 (3.1)	3.3 (2.8)	4.2 (2.3)	4.7 (2.1)	3.6 (1.7)	4.5 (2.0)

DATA SOURCES:
a. Computed from Cuyahoga County Auditor's records of deed transfers compiled by Northeast Ohio Areawide Coordinating Agency and HMDA data averaged for 1977-79.
b. Estimates from Cuyahoga Plan of Ohio, Inc.
c. 1970 census data.
d. Cuyahoga County Court filings.

KEY:
(A) < 10% black in 1970 and 1977.
(B) < 10% black in 1970; 10% to 50% black in 1977.
(C) 10% to 50% black in 1970 and 1977.
(D) 10% to 50% black in 1970; 50% to 90% black in 1977.
(E) 50% to 90% black in 1970 and 1977.
(F) 50% to 90% black in 1970; > 90% black in 1977.
(G) > 90% black in 1970 and 1977.

deflated by the number of owner-occupied housing units within the tract and multiplied by 100. As most foreclosure actions are settled without a formal trial, this variable vastly overestimates the number of actual legal foreclosures. Foreclosure filings, however, seemed to be a much better indicator of potential mortgage losses than the few cases requiring legal adjudication. Note that this variable reflects foreclosures of loans that actually were granted and thus fails to reflect risk differences already incorporated by institutions into their credit-screening procedures.

The final and most important explanatory variable is the characterization of the racial composition of neighborhoods. A number of different specifications of this critical variable were considered. Canner (1979), for example, used the change in percent black as well as a cubic polynomial for the level of racial composition. However, the small number of integrated tracts resulting from the severe nature of Cleveland segregation made such a specification unattractive for purposes of this study. As an alternative, it was decided to characterize race by seven mutually exclusive neighborhood groupings that differentiated tracts by both their levels and changes in racial composition. Racial composition was measured in 1970 (census figures) and again in 1977 (estimates from the Cuyahoga Plan of Ohio, Inc.),[7] and tracts were sorted into the following seven categories:

(1) the percent black was less than 10 percent in both 1970 and 1977;
(2) the percent black was less than 10 percent in 1970 and between 10 percent and 50 percent in 1977;
(3) the percent black was between 10 percent and 50 percent in both 1970 and 1977;
(4) the percent black was between 10 percent and 50 percent in 1970 and between 50 percent and 90 percent in 1977;
(5) the percent black was between 50 percent and 90 percent in both 1970 and 1977;
(6) the percent black was between 50 percent and 90 percent in 1970 and over 90 percent in 1977;
(7) the percent black was over 90 percent in both 1970 and 1977.

Before discussing the regression results, the superficial evidence suggested by the gross variable means in table 3 should be noted. Reading columns from left to right, commercial bank, savings and loan, and total mortgage loans as a percent of transfers each show a significant decline from all-white to all-black neighborhoods. These gross relationships, however, might be very misleading, as median income, median housing value, change in housing value, age of housing structures, and foreclosure actions all show very similar patterns. Without controlling for these other factors, it is impossible to tell whether it is the racial composition of neighborhoods that affects loan availability or other factors correlated with race, such as income.

Regression Results

Results of the first set of regressions are summarized in table 4. Columns denote dependent variables, and rows indicate independent variables, which are identical for each regression. Except for the results reported in column 7, each regression was estimated with ordinary least squares using the entire sample of 335 census tracts. Coefficient estimates are presented as well as their standard errors (precision of estimation). Coefficients that are significantly different from zero at the 1 percent or 10 percent levels are indicated with asterisks. Note that, because of the form of the dependent variables, the coefficients of regressions 1, 2, and 3 always sum to the coefficients of regression 4.

Coefficients for the control variables are listed in the first nine rows and for the most part conform to prior expectations, with some glaring exceptions. As a general rule, older, poverty-stricken, nonprofessional, rental-dominated neighborhoods appear to be significantly less likely to receive loans of any type. Although these general results hold true, there are conflicting, inconsistent coefficient signs in almost every regression. Similarly, median family income, housing values, and foreclosure rates—vari-

7. At the time the study was done, information on racial composition was available from the 1980 census. However, it was decided not to use these data, since they might have been affected by the actions of lenders during the 1977-79 period. The accuracy of the Cuyahoga Plan data can be attested to by the fact that its 1977 racial figures differed from the 1980 census figures by an average absolute deviation of only 3.4 percent, a number consistent with the 7.6 percent average absolute deviation between the 1970 and 1980 censuses.

Table 4 Coefficient Estimates of Static Regressions
Standard errors in parentheses

Independent variables	Dependent variables						
	TOTBNK	TOTS&L	TOTOTH	TOTALL	TOTHI	TOTLO$	TOTALL[a]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	−17.38**	102.70**	7.07	92.39**	32.90*	154.17**	133.20**
	(2.93)	(8.83)	(5.87)	(11.00)	(17.05)	(25.36)	(12.18)
MEDINC	0.78**	−2.00**	0.31	−0.91*	−0.51	1.54	−0.75
	(0.15)	(0.44)	(0.29)	(0.55)	(0.85)	(1.26)	(0.47)
MEDVAL	0.34**	0.14	−0.17	0.30	0.18	−2.04**	−0.19
	(0.08)	(0.25)	(0.17)	(0.31)	(0.49)	(0.73)	(0.30)
CNG%VA	0.016	0.037	−0.016	0.037	−0.134*	0.468**	0.179*
	(0.011)	(0.034)	(0.023)	(0.042)	(0.065)	(0.097)	(0.088)
%<1939	0.026	−0.160**	0.062*	−0.072	0.368**	−0.587**	−0.127*
	(0.018)	(0.053)	(0.036)	(0.067)	(0.103)	(0.153)	(0.067)
%<POV	0.31**	−1.17**	−0.89**	−1.75**	−1.96**	−1.11*	−2.06**
	(0.06)	(0.19)	(0.13)	(0.24)	(0.37)	(0.56)	(0.40)
%PROF	0.19**	0.71**	−0.35**	0.55*	−0.31	1.51**	0.71**
	(0.06)	(0.18)	(0.12)	(0.22)	(0.35)	(0.52)	(0.21)
%OWNOC	−0.032	0.332**	0.128*	0.428**	0.465**	−1.261**	0.071
	(0.027)	(0.082)	(0.054)	(0.102)	(0.158)	(0.234)	(0.112)
CTYFC	0.042	−0.021	−0.005	0.016	−0.531*	0.336	−0.657
	(0.039)	(0.118)	(0.078)	(0.147)	(0.228)	(0.339)	(0.499)
D<10, 10-50[b]	−0.29	−15.45**	6.61*	−9.13*	13.29	−10.42	−6.80
	(1.44)	(4.35)	(2.89)	(5.42)	(8.40)	(12.49)	(5.79)
D10-50, 10-50	−0.53	−11.72*	10.55*	−1.71	68.02**	−19.74	−1.22
	(2.06)	(6.21)	(4.13)	(7.74)	(11.99)	(17.84)	(9.35)
D10-50, 50-90	−8.01**	−33.30**	30.15**	−11.16	87.10**	−7.21	1.74
	(1.89)	(5.71)	(3.80)	(7.12)	(11.02)	(16.40)	(11.91)
D50-90, 50-90	−2.13	−29.24**	26.21**	−5.15	147.31**	−13.85	8.36
	(2.19)	(6.60)	(4.39)	(8.23)	(12.75)	(18.96)	(10.66)
D50-90, >90	−6.10**	−30.57**	40.16**	3.49	149.10**	2.03	29.59**
	(2.10)	(6.33)	(4.21)	(7.89)	(12.22)	(18.18)	(10.99)
D>90, >90	−4.75**	−25.19**	30.61**	0.68	198.28**	6.49	9.61
	(1.61)	(4.86)	(3.23)	(6.06)	(9.39)	(13.96)	(7.67)
R^2	0.74	0.69	0.47	0.64	0.72	0.23	0.84

* Significant at the 10 percent level.
** Significant at the 1 percent level.

a. Weighted by the number of owner-occupied units.
b. These last six independent variables are dummy variables representing different neighborhood racial classifications. As shown in the key to table 3, the first number represents the percentage black in 1970; the second number represents the percentage black in 1977.

ables that *a priori* one would expect to be important—have insignificant coefficients in all but a few regressions.

The most important coefficients for the purposes of this study are the estimated effects of neighborhood racial composition. Coefficients for the six integrated and all-black areas of the seven neighborhood classifications are listed in the last six rows of table 4. These neighborhood coefficients represent mean shifts (intercept) in the dependent variables measured against the all-white neighborhoods (less than 10 percent black in both 1970 and 1977). The coefficients thus can be directly interpreted as differences in the percentage of transfers financed. One would expect integrated neighborhoods (D10-50, 10-50), for example, to have 11.72 percent less of their transfers financed by savings and loans than comparable all-white neighborhoods.

Although less significant than the raw figures presented in table 3, it appears that, controlling for other demographic variables, banks and savings and loans are still less likely to extend mortgage credit in integrated and all-black areas (regressions 1 and 2). Interestingly, changing neighborhoods fare worse than comparable stable areas, a fact consistent with arguments suggested earlier. The least attractive neighborhoods appear to be those shifting from a majority white in 1970 to a majority black in 1977 (D10-50, 50-90). Note that the magnitude of these differences, particularly for savings and loans, is quite large. The average intercept shift of –30 between all-white and predominantly black neighborhoods represents a drop of one-third in the approximately 90 percent of all-white neighborhood transfers financed by savings and loans.

Mortgage bankers appear to have exactly the opposite pattern as banks and savings and loans (regression 3). Black neighborhoods appear to be more, rather than less, likely to receive broker financing with most of these FHA/VA government-insured loans (75 percent of FHA/VA loans in the county originated from mortgage bankers). Thus, looking at total mortgage lending (regression 4), the attractiveness of black neighborhoods to mortgage bankers offsets most of the absence of bank and savings and loan lending in these areas. Thus, on net, only the transitional neighborhoods (D<10, 10-50 and D10-50, 50-90) fare significantly worse than all-white neighborhoods, and these effects are modest.

Home-improvement loans appear to show similar patterns to mortgage-banker lending (regression 5). Black neighborhoods appear to be significantly more likely to receive home-improvement loans than all-white neighborhoods (most of these loans are issued by banks at rates higher than those for first mortgages, with shorter maturities, and are collateralized by housing liens). This is particularly true for stable all-black neighborhoods (D>90, >90). Aggregating all sources of equity financing, total loan dollars (regression 6) exhibit a similar pattern to total mortgages (regression 4). Total funds flowing to the six categories of integrated and all-black neighborhoods do not appear to be significantly different from those flowing to comparable all-white neighborhoods.

The 335 census tracts used in the study were weighted equally in the six regressions. Because neighborhoods represent aggregates of different sizes, however, a case can be made for weighting observations by various measures of tract size. A formal basis for this argument is that aggregation makes it likely that regression errors will be heteroskedastically, rather than identically, distributed. An attempt was made to correct for this by weighting observations by the number of one-to-four unit owner-occupied houses as a representative measure of tract size. The regression for total mortgage loans was then re-run using the weighted observations (regression 7). With one exception, coefficient signs and significance levels are similar to the unweighted regression. Interestingly, however, some transitional neighborhoods (D50-90, >90) now appear to be significantly more likely to receive funding than comparable all-white areas.

Unfortunately, the first set of regressions, which form the basis for most of the analysis, fails to capitalize on the temporal features of the data base. Although three years is a relatively short time in the slowly changing world of mortgage lending, some simple dynamic relationships were examined in a second set of regressions. In particular, yearly changes in the six measures of loan activity were compared with changes in neighborhood racial composition (the only variables for which there were measures for each year). The contemporaneous change in racial composition and lagged changes for three

Table 5 Coefficient Estimates of Dynamic Regressions
Standard errors in parentheses

Independent variables[a]	Dependent variables						
	ΔTOTBNK	ΔTOTS&L	ΔTOTOTH	ΔTOTALL	ΔTOTHI	ΔTOTLO$	ΔTOTALL[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONSTANT	1.47*	−0.086	−0.73	0.651	−8.61*	1.41	0.03
	(0.86)	(1.888)	(0.80)	(2.37)	(4.45)	(0.908)	(6.69)
Lagged 3 Δ%BLACK	−0.047	0.284	−0.175	0.062	0.084	0.041	0.094
	(0.152)	(0.334)	(0.142)	(0.418)	(0.786)	(0.160)	(0.607)
Lagged 2 Δ%BLACK	−0.178	−0.319	−0.051	−0.548	−0.758	−0.322*	−0.852
	(0.164)	(0.359)	(0.153)	(0.450)	(0.846)	(0.173)	(0.671)
Lagged 1 Δ%BLACK	−0.077	−0.914**	−0.260	−1.252**	−1.089	−0.287*	−1.860**
	(0.152)	(0.334)	(0.142)	(0.418)	(0.786)	(0.160)	(0.638)
Δ%BLACK	0.071	0.225	0.029	0.325	1.017	−0.084	0.756
	(0.130)	(0.286)	(0.122)	(0.359)	(0.674)	(0.138)	(0.532)
D1979	−2.89*	1.42	0.81	−0.66	−6.83	−0.74	2.30
	(1.16)	(2.55)	(1.08)	(3.19)	(6.00)	(1.22)	(7.89)
R^2	0.01	0.02	0.01	0.02	0.01	0.01	0.10

* Significant at the 10 percent level.
** Significant at the 1 percent level.

a. The percentage change in black variables represents the change in the percentage black for the contemporaneous year and the change in the percentage black for one, two, or three years earlier. The dummy variable represents changes in 1979.
b. Sample uses the 75 integrated census tracts, excluding all tracts below 10 percent or above 90 percent black in both 1970 and 1977.

years were chosen as independent variables. Dependent variable changes were measured from 1977 to 1978 and from 1978 to 1979. Thus, each tract provided two observations, for a total of 670. A dummy intercept shift differentiated 1978 from 1979 observations. Results for the dynamic regressions are shown in table 5. Columns again denote dependent variables, and rows designate independent variables. The few significant coefficients are indicated with asterisks.

The dynamic regression fits are not terribly impressive. The R^2s are not significantly greater than chance. There is some mild evidence, however, of a modest pattern. Lending of all types appears to decline one year after a rise in the percentage black in a neighborhood. This effect is significant for savings and loans and total lending and is echoed by more modest declines for two-year lags. Because the data are dominated by all-white and all-black tracts, the total lending regression was re-run, using only the 75 integrated tracts most likely to undergo racial change (regression 7). Though more significant, results were similar to those obtained using all the tracts. In all cases, the evidence shows some support for the contention that changing neighborhoods would be the ones more susceptible to limitations in mortgage lending and that lenders might react to changes in relatively short periods of time.

IV. Conclusions

Controlling for income and other demographic variables, it appears that neighborhood racial composition has little impact on the total number of deed transfers financed by mortgage loans and on total housing-related financing. However, it also appears that the portion of mortgage financing provided by banks and savings and loans is significantly lower in integrated and all-black neighborhoods than in all-white neighborhoods. This is particularly

prevalent in changing neighborhoods where the percentage of blacks is rising. On the other hand, black and racially mixed areas are significantly more likely to be served by mortgage bankers offering FHA/VA financing. Similarly, banks and savings and loans are much more likely to make home-improvement loans in these areas.

It should be stressed that these findings, like those of previous redlining studies, are based on reduced-form regressions. It is difficult to know whether there have been sufficient controls for demand and risk factors such that strong inferences can be drawn about supply. There is also a concern that the seven-year to nine-year gap between the lending data and 1970 census tract demographics may have caused distortions, particularly in changing neighborhoods. Despite these misgivings, however, the strong correlation between neighborhood racial composition and the type of lending warrants some discussion.

On the surface, it appears that banks and savings and loans are not serving the "credit needs" of black neighborhoods if the word *serve* is interpreted to mean conventional mortgage lending. Indeed, controlling for income and other neighborhood characteristics, financial institutions are significantly less likely to finance title transfers with conventional mortgages in black and racially mixed neighborhoods. This finding would constitute redlining under the definition used earlier. On the other hand, it appears that funds are being made available to these neighborhoods either through FHA/VA mortgage-banker financing or home-improvement loans.

One explanation for this pattern is that, as argued earlier, financial institutions may feel that all-black and/or integrated neighborhoods are more risky than comparable all-white neighborhoods. Because of this higher perceived risk, banks and savings and loans may reason that they cannot offer conventional mortgage loans in these areas at the same rates as in white areas or at rates that can compete with government-insured and sometimes subsidized loans. They could, of course, offer conventional financing but at higher rates. However, there seems to be a reluctance to offer differential interest rates by neighborhood. A more likely alternative would be to offer the same rate but set higher credit standards in risky neighborhoods, thus relegating a higher fraction of the mortgage business to other lenders. Over time, real-estate brokers, recognizing this fact and knowing the high transactions costs involved in mortgage applications, would steer high-risk neighborhood clients to FHA/VA-insured mortgage bankers where applications more likely would be accepted.

The pattern observed in black neighborhoods with home-improvement loans is consistent with this scenario. Home-improvement loans offer a method of housing-related financing at higher rates and shorter maturities than first mortgages. If houses are renovated after, rather than before, their sale, home-improvement loans allow part of the equity to be financed at higher rates and also reduce the need for first-mortgage financing.

Even if it is true that redlining is more a matter of lender type and price than restrictions on credit availability, there may still be a case for regulatory concern. Although houses that change hands in black areas appear to be as likely to receive financing as those in comparable white neighborhoods, the long-term absence of conventional bank and savings and loan lending in these areas may mean that fewer houses change hands or that selling prices are lower. Some also have argued that widespread FHA/VA financing may lead to more rapid neighborhood deterioration (see King 1980). However, there has been little or no legal guidance as to which actions constitute discriminatory mortgage lending. It is still not clear, for example, whether differential lending policies in white and black neighborhoods by themselves constitute violations of any federal discrimination law. In the absence of clear-cut judicial decisions, it is difficult for regulatory bodies to enforce existing laws that have yet to be tested.

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