FILE COPY

New England Economic Review

Federal Reserve Bank of Boston

July/August 1993

Stephen K. McNees — *The Discount Rate: The Other Tool of Monetary Policy*

Katerina Simons — *Interest Rate Structure and the Credit Risk of Swaps*

Robert Tannenwald — *How Dependent Are New England's Mid-Sized Firms on the Region's Largest Bank Holding Companies?*

President
Richard F. Syron

Senior Vice President and Director of Research
Lynn E. Browne

Research Department:
Banking Studies
Eric S. Rosengren, Vice President
Joe Peek
Robert Tannenwald

Financial Markets
Richard W. Kopcke, Vice President
Richard E. Randall, Vice President
Stephen R. Blough
Katerina Simons

Open Economy Macroeconomics
Stephen K. McNees, Vice President
Jeffrey C. Fuhrer
Jane Sneddon Little
Geoffrey M. B. Tootell

Regional
Katharine L. Bradbury, Assistant Vice President
Yolanda K. Kodrzycki
Christopher J. Mayer

The **New England Economic Review** is produced in the Research Department and is edited by Joan T. Poskanzer. Heather Schofield coordinates the design and production. The views expressed are those of the individual authors, and do not necessarily reflect official positions of the Federal Reserve Bank of Boston or the Federal Reserve System. The authors will be glad to receive comments on their articles. The Review is available without charge. Requests to be placed on the mailing list or for additional copies should be sent to the Research Library–D, Federal Reserve Bank of Boston, P.O. Box 2076, Boston, MA 02106-2076. Articles may be reprinted if the source is credited. Please send copies of the reprinted materials to the editor.

Contents

The Discount Rate: The Other Tool of Monetary Policy

Stephen K. McNees

Although open market operations are clearly the primary monetary policy tool, the discount rate is not without influence. Federal Reserve Banks propose any discount rate changes, and the Board of Governors decides whether to accept, reject, or take no action on their requests. This article examines the involvement and influence of the various Reserve Banks in this process, exploring their participation over a 20-year period. The historical analysis shows that Reserve Banks differ in the frequency, persistence, and direction of their proposals for change.

The article also develops statistical models for the decision procedures of the Reserve Banks in proposing a change and for the Board's rulings on those proposals. Both pay particular attention to labor markets, financial markets, and inflation or monetary aggregates. Results also show that the number of Reserve Bank proposals before the Board does play an independent role in the Board's decisions, above and beyond national economic conditions. 3

Interest Rate Structure and the Credit Risk of Swaps

Katerina Simons

Swap contracts have grown tremendously in the last decade. Most are interest-rate swaps, the simplest being an exchange of one party's fixed-rate interest payments for another's floating-rate payments. Swaps can lower borrowing costs for both parties as well as provide a tool for managing interest-rate risk. As the market for swaps grows and matures, understanding and measuring the accompanying credit risk remains a concern of bankers, regulators, and corporate users.

The credit risk of swaps arises when one party defaults and interest rates have changed in such a way that the other party can arrange a new swap only on inferior terms. It involves only the cash flows exchanged by the counterparties, and not the underlying notional principal. Previous work has used simulations of the future course of interest rates to analyze swaps' credit risk. This study adds the interest rate forecast

Contents

implicit in the yield curve to the randomly generated interest-rate scenario used in the simulations. The author shows that credit exposure is greater for longer maturities and when future rates are expected to be higher, and that the risk rises and then falls over the life of the swap. 23

How Dependent Are New England's Mid-Sized Firms on the Region's Largest Bank Holding Companies?

Robert Tannenwald

The degree to which mid-sized firms—the "middle market"—depend on large regional banks for short-term credit is an issue particularly relevant to New England. If this dependence is heavy, then the recent consolidation among the region's large bank holding companies could be forcing its mid-sized firms to accept short-term credit on uncompetitive terms. The dependence of New England's middle market on the region's banking institutions as a whole, both large and small, is also of concern. The greater this dependence, the more vulnerable are the region's mid-sized firms to sharp contractions in the availability of bank credit, such as the regional "credit crunch" that occurred during the early 1990s.

In order to address these issues, the Federal Reserve Bank of Boston surveyed the credit sources of the region's middle market firms. The results show that such firms are by no means exclusively dependent on the region's largest commercial banks, suggesting that uncompetitive pricing is currently not a concern. The implications of the survey's results for the vulnerability of the region's mid-sized firms to credit crunches are less clear. The degree to which these firms depend on the region's banks as a whole for short-term credit varies with the measure of dependence used. 35

The Discount Rate: The Other Tool of Monetary Policy

Stephen K. McNees

Vice President and Economist, Federal Reserve Bank of Boston. *The author is indebted to Herb Wass for acquiring the data, Delia Sawhney for carefully compiling the data, Kim Warner for estimating the equations, Normand Bernard and Gary Gillum for comments, and especially Geoffrey Tootell for valuable advice on LOGIT modeling.*

Open market operations—purchases and sales of government securities—are clearly the primary tool of monetary policy. The aggregative effect of changes in the discount rate or in reserve requirements can easily be swamped by a sufficient volume of open market operations. Nonetheless, for several reasons, the discount rate is not simply an irrelevant ornament in the standard list of the tools of monetary policy.

First, changes in the discount rate may influence current open market operations or signal a future change in monetary policy. For example, under a strict borrowed reserves operating regime, the targeted level of borrowing determines the difference between the federal funds rate and the discount rate, and a change in the discount rate can be expected to pass fully through to the federal funds rate, so long as the borrowing target remains unchanged. Previous research on the effect of the discount rate on open market operations has reached mixed conclusions.[1]

Second, because the discount rate is an administered rate that has been moved in discrete steps ranging from 25 to 100 basis points, it is less volatile and more visible than most other short-term money market rates, with the possible exception of the prime rate. Changes in the discount rate are reputed to have an "announcement effect"—more like the banging of a gong than the ringing of a doorbell. Moreover, movements in the discount rate tend to persist in the same direction. As will be illustrated below, the past 20 years have exhibited four (or perhaps only three) discount rate cycles.

Finally, changes in the discount rate may contain different information than changes in open market operations because the two policy tools are determined in different ways. Open market policy is determined by the voting members of the Federal Open Market Committee—the seven members of the Board of Governors of the Federal Reserve System and five of the Reserve Bank presidents. The discount rate is

determined by a more complex, or at least less familiar, two-step process: the board of directors of each of the 12 Federal Reserve Banks meets, as required by law, no less frequently than every two weeks, to propose a discount rate. The results of their deliberations are conveyed to the Board of Governors in Washington. The Board of Governors may deny, approve, or table the proposals made by the Reserve Banks' boards of directors.[2]

The two-step procedure is an example of a system of checks and balances, a compromise between a centralized and a federal distribution of power. No Reserve Bank can change its rate without Board of Governors approval, but because, in practice, Reserve Banks initiate changes, the Board could favor a rate other than the prevailing one.[3] This unusual, rather subtle procedure leaves the Board with full control and the Reserve Banks with no control of the exact timing of changes. A Reserve Bank may wish to propose a change either if it would like to see an immediate change or if it expects a change might be desirable in the near future. In deciding on the precise timing of the change, the Board is in a position to respond rapidly to sudden or unexpected incoming information. Only the Board, for example, is in a position to take account of understandings with foreign central banks.

The discount rate procedure is an example of a system of checks and balances.

In extreme cases, the initiative for changing the rate is fairly clear. On occasion, the Board of Governors has favored a change and, because no proposals for change had been submitted, has made known its willingness to approve a proposal. On July 19, 1979, for example, the Board of Governors received a proposal from the New York Bank and approved it the same day. At the other extreme, on two occasions in the past 20 years, the Board of Governors did not act until it had received proposals from all 12 Reserve Banks (April 1973 and October 1977). In these cases it seems reasonable to conclude that the initiative for the change sprang from the Reserve Banks rather than the Board of Governors!

These cases were chosen to illustrate the extremes. More typically, determination of the discount rate stems from an interactive nonadversarial process in which one (or more) Reserve Bank(s) first proposes a change and the Board disposes. More than three-quarters of discount rate changes in the last 20 years have been made when between four and 10 Reserve Banks have proposed the change.

The focus of this article is the process by which the discount rate is determined. It starts with a summary description of the 12 Reserve Banks' proposals, culled from the Board of Governors' minutes over the past 20 years. It then turns to a chronological history of Reserve Bank proposals and actual changes. It next attempts to model formally the decision procedures of the 12 Reserve Banks. It concludes by presenting a formal statistical model of how the Board of Governors has disposed of the Reserve Banks' discount rate recommendations.

I. Reserve Banks' Discount Rate Proposals

The propensity to propose discount rate changes has varied both among Reserve Banks and over time. As shown in Table 1, column 1, over the past 20 years Dallas has been the most frequent proponent of changes in the discount rate, having a proposal on the table at nearly one-third of the meetings of the Board of Governors, more than twice as frequently as several other Banks.[4] But that has not always been true: in the first 10-year period, Chicago was the most active Reserve Bank and Dallas was among the least active (column 2). Dallas is the only Bank whose activism clearly increased in the last 10 years (column 4). The sharp increase in Dallas's activism has been roughly offset by the reduced activism at most other Reserve Banks, especially those in the Kansas City, Atlanta, and Chicago Districts, leaving the average

[1] See Roley and Troll (1984), Smirlock and Yawitz (1985), Cook and Hahn (1988), Dueker (1992), and Wagster (1993).

[2] In early 1988, tabling was replaced by the more informal procedure—which requires no vote—of simply "maintaining" the existing rate when neither approval or disapproval of a request is voted. Because "tabling" prevailed over most of the period under investigation, that term will be used here to also describe the determinations to maintain the existing rate in recent years.

[3] The Board of Governors may have the power to require the establishment of a particular discount rate even in the absence of a Reserve Bank proposal. This power has apparently not been exercised since 1927, when the Board imposed a rate reduction on the reluctant Chicago Reserve Bank.

[4] The Reserve Bank discount rate proposals in this paper were taken from the minutes of the meetings of the Board of Governors in the 20-year period from January 1973 through December 1992.

Table 1
Reserve Bank Activism: Proposals to Change the Discount Rate
Percentage of Meetings

Reserve Bank	1973–92 (1)	1973–82 (2)	1983–92 (3)	Difference (4) = (3) − (2)	Proposal Submitted at Time of Approval[a] (5)
Dallas	29	15	41	26	54
Chicago	25	31	20	−11	68
Cleveland	21	21	21	0	44
San Francisco	21	24	19	−5	59
Atlanta	21	28	15	−13	48
Boston	19	19	20	1	62
St. Louis	16	20	12	−8	40
New York	14	15	13	−2	75
Kansas City	14	22	7	−15	56
Philadelphia	13	16	11	−5	59
Minneapolis	12	15	9	−6	49
Richmond	11	13	10	−3	44
Average	18	20	17	−3	55

Note: Ordering based on column (1).
[a]Column (5) is the percentage of all discount rate changes.
Source: Minutes of meetings of the Board of Governors of the Federal Reserve System, compiled at the Federal Reserve Bank of Boston.

frequency of recommendations for change by a Reserve Bank fairly stable over time, at about 20 percent. The existence of long periods with no proposals for change affects the choice of statistical method used below to examine the determinants of discount rate proposals.

Activism is, of course, not a reliable proxy for "effectiveness" or "influence." It is easy to imagine a very active Bank that always recommended the same thing or always was out of sync with broader sentiment and, thus, would have little influence on the discount rate. Similarly, it is easy to imagine a Bank that made few proposals but whose proposals were a reliable precursor of the future discount rate.

Column 5 of Table 1 shows the frequency with which each Bank had submitted a proposal at the time when the discount rate was changed. The raw data were adjusted to include those occasions when a Reserve Bank had previously proposed the change but it had been denied or tabled, and the Directors had not yet met again before the change was made.[5] The table reveals that New York and St. Louis had the extreme positions—New York had submitted a proposal to change in the case of 75 percent of the actual changes, whereas St. Louis had submitted a proposal for change only 40 percent of the times when changes were made.

The fact that New York was most frequently among the group of Banks whose requests were approved does not prove that New York's proposal was the most influential. Banks often join in well after the sentiment for change has been well established. In an important sense, the Reserve Bank that *first* proposes a change may be better described as the initiator of the change that subsequently occurs.

Table 2 provides information about which Reserve Banks first proposed a discount rate change in the same direction as the subsequent actual change. The left half of the table gives the number of times each Bank was the first (column 1), among the first (column 2), and either first or among the first (column 3) to propose the direction of the next change in the discount rate. Chicago was most frequently the first and New York least frequently the first to propose change.

This way of ranking suffers, however, from the problem that nearly one-third of the time, the first

[5] For example, Kansas City had proposed a 50-basis-point increase in the discount rate, which the Board of Governors denied at its June 25, 1973 meeting; the Board denied a similar request from Boston the next day. Yet, when the Board approved five Banks' requests for an increase on June 29, 1973, neither Kansas City nor Boston was among those whose proposals were approved because their directors had not met again in the time between the denial and the acceptance. It seems reasonable to assume that each Bank still favored its previous proposal, and so both Banks are counted as having favored the increase that occurred.

Table 2
Reserve Bank Leaders: Direction Only of Discount Rate Change, 1973 to 1992
Number of Proposals

	Ignoring Interruptions			Uninterrupted		
	First	Among First	Total	First	Among First	Total
Reserve Bank	(1)	(2)	(3)	(4)	(5)	(6)
Chicago	6	15	21	7	14	21
Dallas	3	14	17	2	14	16
Boston	8	7	15	8	6	14
San Francisco	3	10	13	3	11	14
Cleveland	2	8	10	4	9	13
Atlanta	1	6	7	2	7	9
St. Louis	2	7	9	1	8	9
Philadelphia	2	8	10	1	7	8
Minneapolis	3	6	9	2	5	7
Kansas City	3	4	7	3	2	5
New York	0	4	4	2	3	5
Richmond	3	4	7	0	3	3
All Reserve Banks	36	93	129	35	89	124
Average	3.0	7.8	10.8	2.9	7.4	10.3

Note: Ordering based on column (6), with column (4) as tiebreaker.
Source: See Table 1.

Bank to propose a change fails to resubmit its proposal later. The clearest example of this occurred in late 1981, when San Francisco was the first to propose a 100-basis-point cut in the discount rate. After the San Francisco proposal had twice been tabled by the Board of Governors, it was not submitted again. By February 1982, San Francisco was proposing a 100-basis-point *increase* in the discount rate. It is hard to construe this as a case of San Francisco's influencing the next change in the discount rate, a 50-basis-point *reduction* (July 19, 1982), which the Chicago Bank had been proposing persistently since March of 1982.

To correct for these "interrupted" proposals, the right half of Table 2 presents the number of times each Reserve Bank was first (column 4), among the first (column 5), and either first or among the first (column 6) to persist, *without interruption*, in proposing a change. This seems a more sensible proxy for initial influence or leadership. Note first that the rankings on the right and left sides of Table 2 are little changed when first proposals that subsequently were not repeated are omitted: Chicago, Dallas, Boston, and San Francisco still rank near the top. One exception is Atlanta, relatively seldom the first to propose a change but, because it continues to resubmit its early proposals, fairly typical in first proposing and then maintaining its change proposal. Second, contrast this table with column (5) in Table 1. New York, so frequently included among the Banks whose requests were approved, is seldom among the first to propose a change according to any of these measures. Active Banks like Dallas and Chicago are frequently the first, whereas relatively inactive Reserve Banks like Kansas City and Richmond are seldom first to propose the change.

Table 2 is based solely on the first proposal to change in the actual direction, regardless of the magnitude of change proposed. Some may believe that the magnitude of the proposal is also important. Proposals to change the discount rate have ranged in size from a 300-basis-point increase (by Cleveland on March 31, 1980) to a 200-basis-point decrease (by Chicago, St. Louis, Minneapolis, and Dallas in the spring of 1980), although actual changes have not exceeded 100 basis points since 1920, when the discount rate was once changed by 125 basis points. Virtually all of the proposals to change by 100 basis points or more came in the tumultuous period from October 6, 1979 to early 1982, the period in which the Federal Reserve adopted an operating procedure that allowed for larger changes in short-term interest rates. Since 1982, proposals to change the rate by more than 50 basis points have occurred only three times, in July 1984 when Dallas requested an increase

Table 3
Reserve Bank Leaders: Direction and Correct Magnitude of Discount Rate Change, 1973 to 1992
Number of Proposals

	Ignoring Interruptions			Uninterrupted		
	First	Among First	Total	First	Among First	Total
Reserve Bank	(1)	(2)	(3)	(4)	(5)	(6)
Chicago	4	15	19	5	13	18
Dallas	3	11	14	3	11	14
Cleveland	2	10	12	3	11	14
Boston	6	7	13	4	8	12
New York	2	7	9	5	6	11
San Francisco	1	9	10	2	8	10
St. Louis	2	10	12	1	9	10
Philadelphia	2	9	11	1	9	10
Atlanta	1	8	9	2	7	9
Richmond	1	9	10	1	8	9
Kansas City	3	6	9	2	4	6
Minneapolis	3	6	9	2	3	5
All Reserve Banks	30	107	137	31	97	128
Average	2.5	8.9	11.4	2.6	8.0	10.7

Note: Ordering based on column (6), with column (4) and column (3) as tiebreakers.
Source: See Table 1.

of 100 basis points, in early 1989 when Cleveland sought a 100-basis-point increase, and in December 1991 when New York and Chicago's proposals for a 100-basis-point reduction were approved.

Table 3 ranks the Reserve Banks in the same way as Table 2 for the first Reserve Bank to propose the correct direction *and* magnitude of the next change in the discount rate. The overall rankings are quite similar, although a few Banks' relative positions do shift. New York, and to some degree Cleveland, are relatively much more successful in being the first to continually propose the direction and magnitude of the change, as opposed to only its direction. In contrast, Atlanta and Minneapolis were relatively less successful in first proposing the correct magnitude and direction rather than simply the direction of the next change.

Omitting interrupted proposals affects the ranking of a few Banks. For example, as shown in Table 2, New York was seldom first to propose the direction of change whether or not discontinued proposals are counted. New York was also seldom the first to propose the correct magnitude (Table 3), but because it was persistent in its proposals, New York was fairly typical in the frequency with which it initiated an uninterrupted proposal of the correct magnitude. New York, like Atlanta, was relatively slow to act, but persistent. Kansas City and Minneapolis show the opposite tendency. They were first to propose the correct magnitude of change nearly as often as the average Reserve Bank. However, because relatively often they did not resubmit these proposals, they were seldom first to propose the correct magnitude on an uninterrupted basis. New York and Atlanta were relatively persistent, whereas Minneapolis and Richmond were somewhat tentative in their messages.

Proposals to change that are not subsequently resubmitted send a weaker, more ambiguous signal than proposals that are offered persistently. Table 4 looks directly at Reserve Banks' tendency to withdraw their proposals, not just at first proposals as shown in Table 3; it distinguishes between proposals not resubmitted after having been tabled by the Board of Governors and those not resubmitted after denial. Denial is commonly thought to suggest that the proposal has little chance for approval in the near future, whereas tabling is essentially noncommittal about prospects for approval.

The first column of Table 4 shows the total number of proposals discontinued. Chicago, one of the most activist Reserve Banks and frequently among the first to propose a change, is also the leader

Table 4
Withdrawn Discount Rate Proposals, 1973 to 1992

	All Withdrawn Proposals		Withdrawn Proposals in "Correct"[a] Direction	
	Total	Excluding Denials	Total	Excluding Denials
Reserve Bank	(1)	(2)	(3)	(4)
Boston	6	1	3	1
New York	8	4	6	3
Minneapolis	7	4	6	4
Kansas City	11	4	7	3
San Francisco	18	11	7	4
Richmond	10	4	8	2
St. Louis	14	4	8	3
Philadelphia	12	5	8	3
Cleveland	19	8	10	2
Atlanta	16	8	10	3
Dallas	18	10	11	5
Chicago	19	5	13	4
All Reserve Banks	158	68	97	37
Average	13.2	5.7	8.1	3.1

Note: Ordering based on column (3), with column (4) and column (2) as tiebreakers.
[a]"Correct" direction is that of the subsequent actual change.
Source: See Table 1.

in the total number of proposals discontinued. Boston is the least likely to withdraw its proposals.

It can be argued that choosing not to resubmit a denied proposal is not wavering but merely a rational response to the prospects for achieving the desired change. Column (2) shows the number of proposals dropped after having been tabled; it excludes proposals discontinued after denial. By this measure, San Francisco and Dallas change their mind by far the most frequently, whereas Chicago is only about average.

While columns (1) and (2) are measures of the "noisiness" or ambiguity of a Bank's recommendations, only in retrospect can we distinguish between "stubbornness" (proposals to change in the direction opposite to the subsequent actual change) and simple lack of persistence (failure to resubmit proposals in the direction of actual change). Column (3) gives the total number of proposals in the same direction as the next change that were discontinued. Chicago was the most likely, and Boston the least likely, to withdraw its proposal when proposals in the opposite direction from the next change are excluded. This table ranks the Reserve Banks by this measure.

For those who believe withdrawal is the appropriate response to Board of Governors denial, column (4) lists the number of proposals in the same direction as the next change that were withdrawn from the table. Dallas most frequently did not resubmit tabled proposals in the same direction as the next change, while Boston was the most persistent in sticking to its point of view.

As the previous discussion suggests, it is not possible to measure "effectiveness," "influence," or "leadership" without considering whether the proposals were appropriate. This study turns next to proposals in the opposite direction from, or "out of sync" with, the subsequent change. If actual policy were ideal in both timing and magnitude, these proposals could be regarded as "wrong."

Once it is acknowledged, however, that policy mistakes could have been made, some of these out of sync proposals can be regarded as more insightful or more foresighted than the actual policy. Some of these proposals appear defensible, or at least arguable, even in retrospect. Every proposal undoubtedly seems reasonable at the time it is offered, before the fact. Given the great uncertainty that surrounds the economic future, it is always possible to argue that the risk of accelerating inflation warrants policy restraint or that the risk of a recession warrants policy ease. Even if the risks do not materialize, it can often be wise to insure against a risk of sufficient gravity. It is also possible, of course, to spend too much on insurance or to systematically overestimate the risks.

Table 5 presents information on all discount rate proposals that were of the opposite sign from the next actual change. Several of these proposals were entirely appropriate. The clearest example occurred in March 1980, when four Banks proposed increasing the discount rate by 100 basis points and seven Banks proposed increasing the rate by 200 basis points, to 15 percent. Even though the next change in the basic discount rate was a 100-basis-point reduction on May 28, 1980, the Board of Governors' immediate response to the 11 Banks' March recommendation of an increase was the imposition of a surcharge on the discount rate for loans to large banks. Advocates could justifiably argue that their proposals proved in retrospect to be in the correct direction, insofar as the stability of the base rate was more technical or symbolic than substantive.

More debatable cases center on the timing of discount rate changes and the lag in the impact of

Table 5
"Out of Sync" Discount Rate Proposals, 1973 to 1992

Reserve Bank	Total (1)	Excluding Arguable (2)	Least Defensible (3)
Minneapolis	2	0	0
New York	2	0	0
Boston	3	1	0
Chicago	3	1	0
Philadelphia	3	1	0
Richmond	3	2	1
Kansas City	5	3	1
Atlanta	5	4	1
St. Louis	5	4	1
Dallas	6	4	1
Cleveland	6	5	1
San Francisco	8	6	2
All Reserve Banks	51	31	8

Note: Ordering based on column (2), with column (1) as tiebreaker and alphabetical thereafter.

Frequency Distribution of Proposals

13—1980	2—1990
8—1983	2—1988
6—1976	2—1981
5—1984	2—1974
5—1982	1—1975
4—1987	1—1973

Source: See Table 1.

monetary policy. In general terms, the history of discount rate changes over the past 20 years can be condensed into four, or perhaps even three, major cycles. The upswings and downswings, discussed in detail in the next section, are illustrated in Figure 1. These cycles suggest dividing "out of sync" proposals to change the discount rate into three categories, each with different severity. The proposals most difficult to understand seem to be those to cut (increase) in the midst of a series of increases (cuts). Here the proposal is clearly at odds with policy that later, with additional information, was adopted as appropriate. It is hard to justify such proposals as simply more farsighted than those of their contemporaries.

A second category of out of sync proposals, which in retrospect seems easier to understand, includes the proposals to extend a series of cuts (or increases) somewhat longer than the Board of Governors chose to do. Is one additional tightening in a period of accelerating inflation clearly a mistake? Is one additional easing toward the end of a period of stagnation really a mistake? Defendants of such a proposal could argue forcefully that the series of moves should have been continued, so long as they acknowledge the need to reverse their proposal at a later date.

A third type of out of sync proposal deals with the opposite concern: should a series of increases (or cuts) be stopped, one step before the final move? Did actual policy persist too long in the same direction?

Specifically, on two occasions, in 1973 and 1983, the out of sync proposals did not reflect the direction of the very next change but were in the same direction as the following *series* of changes. In 1983, seven banks wanted to continue the series of reductions made during the 1981–82 recession. In fact, the next change was the April 1984 increase, but this increase was followed by a series of cuts starting later in 1984. It can be argued that the April 1984 increase—the only example of a single move in one direction since 1971—was a technical change and not a shift in policy. Even if the April 1984 increase were fully justified, it is doubtful that economic history would have to be rewritten if it had not occurred, and if, instead, the seven banks' requests for further cuts in early 1983 had been approved.

Boston's proposals to cut the discount rate in October and November 1973, at the start of the 1973–75 recession, also seem defensible in retrospect. The severity of the oncoming recession did not become evident for several months, but when it did, and when the limited effect of the oil price shock on the inflation rate (as opposed to the price level) became clear, the discount rate was cut seven times. The discount rate increase of April 24, 1974, while defensible at the time, was at least arguable in retrospect, in light of the severity of the remaining portion of the recession. Granting the undesirability of the increases in inflation in the late 1970s, and even the virtues of a tighter monetary policy to restrain that increase, one can argue that the mistake was made later—the continued cuts in 1975 and 1976 or the limited increases in 1977 and 1988.

The remaining columns of Table 5 enumerate these different types of "out of sync" proposals. Column 2 excludes both the 1980 change and the 1973 and 1983 episodes when the proposals anticipated the direction of the series of changes after the next change. The final column (3) also excludes proposals to extend a series of changes longer than it was in fact extended. It consists only of proposals to change in the midst of a series of changes in the opposite direction (1973, 1982, and 1988).

Interpretations of the information in Table 5

obviously depend on one's view of the appropriate policy goals and one's concept of the way monetary policy influences policy goals. If monetary policy had no impact on economic activity and its only goal were price-level stability, then whenever inflation was positive, an easier policy would be a mistake. If inflation came only from excess demand pressure, tightening would be inappropriate whenever slack occurred.

Table 6 highlights the fact that different Banks have taken different policy views. The table shows the proportion of each Reserve Bank's proposals to change the discount rate that consisted of proposals to increase the rate—this will be referred to here as the Bank's "policy stance." For example, over the entire period, 90 percent of the St. Louis proposals to change the discount rate were proposals to increase the rate. In contrast, only 18 percent of the Dallas proposals were for increases.

Policy stance has varied over time as well as among Banks. Over the entire period, all Reserve Bank proposals combined were evenly split between increases and decreases. In the 1973–82 period of accelerating inflation, proposals to increase dominated (59 percent). In the 1983–92 period of generally decelerating inflation, only 43 percent of the proposals were for increases. Four Banks ran contrary to this general trend: St. Louis, Cleveland, and Richmond maintained a fairly stable policy stance over time. Only Philadelphia's policy stance shifted substantially toward more increases in the later period.

Although suggestive, this table cannot be used to definitively label individual Reserve Banks as liberal or conservative, hawk or dove. A vote to increase rates meant something different in 1979, when inflation was accelerating, than it did in 1982, when the economy was in a recession. Moreover, as the table implies, a Bank's policy preferences or its concept of how policy affects its goals may change over time. This suggests a need to place discount rate proposals in a concrete historical context. The next section is devoted to that task.

Table 6
Reserve Banks' Policy Stance: Proposals to Increase the Discount Rate, 1973 to 1992
Percent of All Proposals to Change

Reserve Bank	1973–92 (1)	1973–82 (2)	1983–92 (3)	Percentage Point Difference (4) = (3) − (2)
St. Louis	90	88	92	4
Cleveland	78	76	80	4
Richmond	75	74	76	2
New York	61	78	44	−34
Atlanta	56	59	52	−7
Minneapolis	48	56	36	−20
Philadelphia	46	41	52	11
Kansas City	43	55	14	−41
San Francisco	38	44	32	−12
Chicago	33	46	17	−29
Boston	26	39	15	−24
Dallas	18	48	9	−39
All Reserve Banks	51	59	43	−16

Note: Ordering based on column (1).
Source: See Table 1.

II. The Chronology of Discount Rate Changes

As illustrated in Figure 1, the history of discount rate changes over the past 20 years can be condensed into four, or perhaps even three, major cycles—four upswings and four downswings. Each phase, defined more precisely in Table 7, will be described chronologically.

The January 1973 to April 1974 Upswing

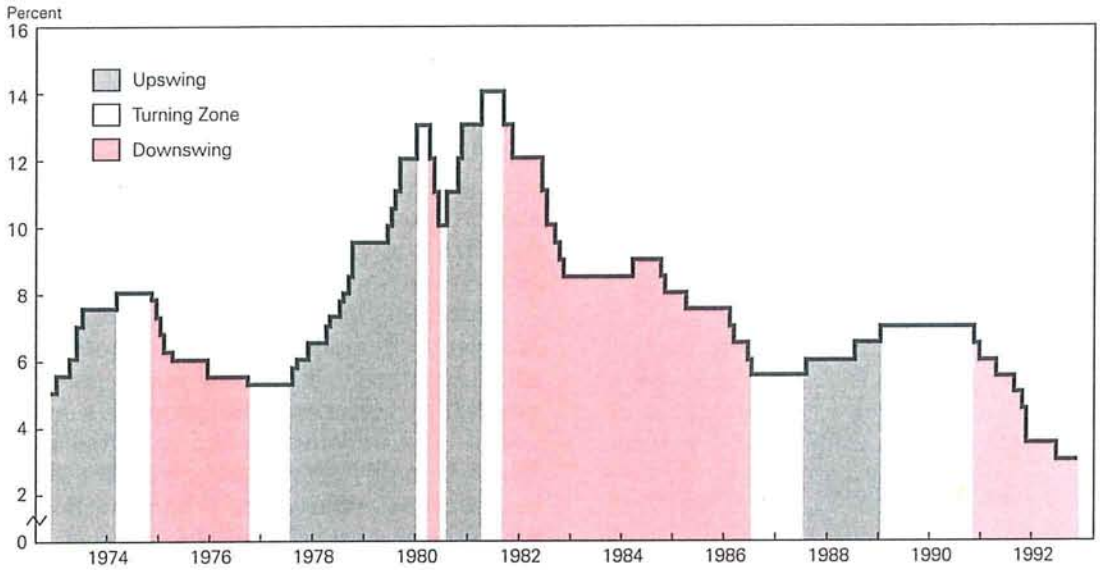
The discount rate was increased from 4½ to 5 percent on January 12, 1973, the first change since December 1971 as the rate had essentially been frozen during Phase II of wage and price controls. Fed Chairman Arthur Burns, who had advocated controls prior to their adoption in August 1971, served as Chairman of the Committee on Interest Rates and Dividends. In late 1972 the Chicago Reserve Bank had been the first to propose an increase (25 basis points), which was denied on January 2, 1973. A San Francisco proposal to increase was merely tabled one week later, and proposals from seven Banks were tabled only one day before the increase was approved.

Once the Phase III thaw of frozen wages and prices was instituted, prices started to rise and the discount rate was raised seven times in seven months (January 12 to August 13, 1973). This upswing took the rate to 7½ percent, well above its previous high of 6 percent, which had prevailed from April 1969 to November 1970. The initiative for raising the rate shifted among the Reserve Banks: Chicago was the first to propose the initial increase, and Kansas City the first to propose both the record-breaking increase to 6½ percent and the subsequent increase to 7

Figure 1

The Discount Rate

January 1973 to December 1992



percent. The breadth of the sentiment to increase rates is illustrated by the fact that all 12 Reserve Banks had proposed the increase that occurred in April 1973, the first of only two unanimous recommendations in the past 20 years, the period of study here. Nine banks had been calling for that increase since March 23, suggesting that this was an instance when the Reserve Banks led the Board of Governors in pushing up the rate. In September 1973, five Banks sought further increases, but their proposals were denied by the Board of Governors.

The OPEC oil embargo and the quadrupling of the price of imported oil complicated the policy picture and ended the unanimous sentiment for rate increases. Interpreting the oil price shock as a one-time increase in the price level rather than an increase in the inflation rate, and fearing a recession, Boston voted continuously from October 1973 through March 1974 for a rate reduction; each request was denied by the Board. The first requests for still another rate increase, by Cleveland and Chicago, were initially tabled, then denied, but resubmitted and ultimately approved in April 1974. St. Louis and Kansas City immediately sought further increases, eventually raising their requests to 100 basis points—what at that time would have been the largest discount rate change since 1933, when two banks changed their rates by 100 basis points—but eventually discontinued their requests after a series of denials.

The December 1974 to November 1976 Downswing

By September 1974, the time of the Whip Inflation Now (or WIN) Conference, the sentiment for rate increases had faded. Atlanta was the first Bank to propose a rate cut, on September 9, 1974, but did not resubmit its proposal after two denials by the Board of Governors. Philadelphia proposed a cut in October that was denied, then it resubmitted its proposal in November. Although this proposal was also denied on November 25, when the proposal was resubmitted and joined by New York it was accepted on December 6, 1974, more than a year after the start of the recession.

Once the severity of the recession became clear, the discount rate was cut four times in four months and seven times over the next year. After each of the first five reductions, at least one Reserve Bank immediately submitted a proposal for a further cut—Boston after the first two, Minneapolis next, then

Table 7
Discount Rate Cycles

Cycle	Upswing	Downswing	Number of Rate Changes	Cumulative Absolute Change (Basis Points)
U1	1-12-73 to 4-24-74		8	350
D1		12-6-74 to 11-19-76	7	275
U2	8-29-77 to 2-15-80		14	775
D2		5-28-80 to 7-25-80	3	300
U3	9-25-80 to 5-4-81		4	400
D3[a]		10-30-81 to 8-20-86	15	850
U4	9-4-87 to 2-24-89		3	150
D4		12-18-90 to 7-2-92	7	400

[a]This classification ignores the April 6, 1984 increase which was reversed November 21, 1984. See pp. 15–16 of the text for the underlying reasoning.
Source: See Table 1.

Kansas City, Boston, and Philadelphia together, San Francisco, and finally Kansas City. Over this period only one proposal to increase the rate was received, submitted by Kansas City on January 10, 1975. This proposal was tabled, whereas a Boston proposal to cut had been denied on January 8 and Philadelphia and San Francisco proposals to cut were to be denied on January 20. The fact that 10 Reserve Banks had submitted reduction proposals by the time a cut was approved on March 7, 1975, and 11 Banks before the May 15, 1975 and January 16, 1976 reductions, suggests that the Reserve Banks again played a primary role in encouraging these discount rate reductions.

After the November 19, 1976 decrease, six Reserve Banks soon sought an additional reduction, but when these requests were denied, they were all withdrawn by January of 1977.

The August 1977 to February 1980 Upswing

The first proposal for an increase came from St. Louis on May 13, 1977, but this request was denied and not resubmitted. A similar proposal by Chicago met the same fate. Atlanta was more persistent, submitting a string of five proposals to increase the rate between May and July of 1977, each of which was denied. After a single interruption, Atlanta resubmitted its increase proposal in early August, and it was again denied. By August 19, however, nine Reserve Banks had submitted increase proposals, and they were approved by the end of the month, the first increase in the discount rate since April 24, 1974.

A month later, Boston proposed a further increase (which was denied) but by October 1977 all 12 Reserve Banks were again asking for increases of at least 25 basis points—eight Banks favored 50 basis points. The Board of Governors approved a 25-basis-point increase on October 25, 1977. Chicago immediately proposed an additional 25 basis points, but after its request was denied, did not resubmit until early 1978.

After the Board had been slow to respond to rate hike requests in 1977—issuing frequent denials and granting approvals only after an unusually large number of Reserve Bank proposals had been received—the initiative shifted from the Banks to the Board in early 1978. Chicago voted a 25-basis-point increase on January 5th. When the Board met the next day, several members argued that "to be effective [in supplementing the recently announced policy of more active intervention in foreign exchange markets], an increase should be at least ½ percentage point and should be accompanied by action by the Federal Open Market Committee to increase the range of the Federal funds rate." Because no proposal to increase by at least 50 basis points had been received and because some Board members questioned the advisability of the increase, it was agreed to postpone action until late in the day. According to the minutes "the tenor" of the "discussion would be conveyed to the Federal Reserve Bank of Chicago, in the event that the Bank's board of directors might wish to propose a ½ percentage point, and to the New York Reserve Bank, whose directors also were thought to be inclined toward such an action."

By the time the Board meeting reconvened later that day, New York had indeed voted a 50-basis-point increase and Chicago had modified its original request to include an increase of either 25 *or* 50 basis points. The two proposals were approved.

This episode illustrates several points. The clearest is that the initiative for change, which rests nominally with the Banks, can be exercised by the Board by conveying its wishes to the Banks and, in effect, eliciting a proposal to change the rate. Second, even though Chicago had first proposed an increase—the proposal that had been discontinued after denial in October 1977—and had been the only

Reserve Bank proposing an increase at the start of the January 6, 1978 meeting, the New York Bank was the first to propose an increase of the magnitude that the majority of the Board preferred. Thus, although Chicago was first to propose the direction of change, New York (and Chicago) were first to propose the direction and correct magnitude of the change. Finally, this instance may help to explain why New York most frequently had submitted a proposal at the time of Board approval.

As a result of its responsibilities for the operations at both the domestic and the foreign trading desks, the New York Bank is in more or less continuous contact with both of these markets and with the thinking of the Federal Open Market Committee. It is not surprising to find the New York Bank to be a highly reliable gauge of the exact timing of discount rate changes even though, as we have seen, it is neither the most active Bank nor commonly the first to suggest a change.

In early March of 1978 G. William Miller became Chairman of the Federal Reserve System. Between May and November of 1978 the discount rate was increased six times in less than eight months. The initial proposals for these increases came from several Reserve Banks, including St. Louis, Atlanta, Minneapolis, and Boston. In September 1978, the discount rate was raised to 8 percent, its all-time high first reached in April 1974. A Boston proposal to increase further to 8¼ percent was denied on October 6, but requests by Boston, along with nine other Banks, to increase were approved only one week later. Once again, a denial was quickly followed by an approval, this time an increase of 50 basis points.

The history of discount rate changes over the past 20 years can be condensed into four, or perhaps even three, major cycles.

Two weeks after this increase, Boston submitted a request to increase by still another 50 basis points but its request was denied October 27, 1978. Four days later, a New York proposal to increase by 100 basis points was tabled but then approved the next day, the first time the discount rate had been increased 100 basis points at one time since 1933. This sequence of events could suggest that the Board had strong views on the exact magnitude and/or timing of the rate change or simply that the Board changed its views rapidly.

After the quick succession of rate increases that culminated with the 100-basis-point increase on November 1, 1978, sentiment shifted again. From December 15, 1978 to May 25, 1979, the period immediately after the revolution in Iran which precipitated another sharp increase in the price of oil, 10 different Reserve Banks (all except Minneapolis and Kansas City) submitted proposals for further increases, all of which were denied and not resubmitted. With concern about an imminent recession widespread, the sentiment for further tightening was not strong. On May 25, 1979 four banks proposed a 25-basis-point increase, but none resubmitted its request once it was denied. Then, when New York voted a 50-basis-point increase, the proposal was approved the same day by the Board. This is the only case in this 20-year period where the Board has approved the request of a single Bank the same day that it was made. It is perhaps the clearest example of how the Board can await, invite, or perhaps even solicit a change from the Reserve Banks.

Shortly after the New York proposal to increase the discount rate to 10 percent had been approved, Paul Volcker, President of the Federal Reserve Bank of New York, became Chairman of the Board of Governors of the Federal Reserve System. One week after Volcker took office, the Board denied a San Francisco proposal to increase the discount rate another 25 basis points. Only three days later, however, proposals by New York, Philadelphia, Richmond, and Kansas City for a 50-basis-point increase were approved on August 16, 1979. Cleveland immediately proposed another 50-basis-point increase which, after the request had been joined by those of eight other Banks, was approved on September 18, 1979.

Boston's proposal to raise the rate by a further 50 basis points was tabled on October 4th, but New York's proposed 100-basis-point increase was approved on October 6, 1979, as part of the special Saturday meeting that changed the Federal Reserve System's short-term operating procedures. Five Banks soon proposed further increases, including 100-basis-point requests from Atlanta, Chicago, and Kansas City. After these requests were tabled by the Board, those from Minneapolis, Kansas City, and Dallas were not resubmitted. Atlanta and Chicago, which had scaled down their requests to 50 basis points and had been joined by Cleveland, did not

renew their requests after Board denial on November 26, 1979.

No further requests for change were received until February 1980, when New York proposed a 50-basis-point increase. The request was subsequently raised to 100 basis points and, after New York was joined by four other Reserve Banks, was approved on February 15, 1980. All Banks except Boston sought further increases of at least 100 basis points; seven were proposing 200-basis-point increases. These proposals were all tabled and were not resubmitted after a special surcharge on large banks' borrowing was approved on March 14, 1980 as part of the credit control program imposed by President Carter. Two weeks later, St. Louis proposed a 200-basis-point increase and Cleveland a 300-basis-point increase, both of which were denied.

The May 1980 to July 1980 Downswing

With the severity of the 1980 recession increasingly clear and market interest rates plummeting, starting in May 1980 three Reserve Banks, Chicago, Minneapolis, and Kansas City, proposed reductions, which were approved May 28, 1980. Five Banks followed immediately with another 100-basis-point reduction proposal, which was approved June 12, 1980, a few weeks before the credit control program was terminated. The same five Banks (Chicago, St. Louis, Minneapolis, Dallas, and San Francisco) proposed yet another round of 100-basis-point cuts, which were approved July 25, 1980, after Dallas had withdrawn its request, San Francisco had raised its proposed cut to 200 basis points, and Richmond and Kansas City had joined in.

It could be argued that this quick succession of cuts was only an aberration and that the upswing that started in August 1977 lasted until May 1981. Though appealing in hindsight, the view is probably an inappropriate interpretation of the feeling at that time. Like the 1980 recession itself, the downturn in rates, although extremely brief, was also extremely sharp. At least from a financial markets perspective, the 300-basis-point decline in the discount rate that accompanied a decline of more than 900 basis points in short-term market rates is simply too large to be called a mere aberration.

The September 1980 to May 1981 Upswing

No further proposals for change were received until St. Louis, which along with Chicago and Minneapolis had been a leading advocate of rate cuts, proposed a 50-basis-point increase, which was denied September 15, 1980. Boston's proposal for a 100-basis-point increase and Atlanta's proposal for a 50-basis-point increase were tabled on September 22, but a 100-basis-point increase by several other Reserve Banks was approved three days later. Four Banks soon proposed still another increase, but their requests were tabled on October 27. Eleven Banks had requested increases ranging from 100 to 200 basis points by the time the 100-basis-point increase was approved on November 14. And by December 1, six Banks were seeking an increase of at least another full percentage point, a proposal that was approved on December 4, 1980. Thus, in less than a year the discount rate quickly fell 300 basis points and then returned to its all-time high for that time of 13 percent.

The history of discount rate proposals shows both a common core and also considerable diversity in the ways the Reserve Banks approach discount rate determination.

Three banks immediately wanted to go further—Richmond and St. Louis proposed adding another 100 basis points and Cleveland 200 basis points. Their requests were initially tabled, then denied in late 1980 and not resubmitted. No further changes were proposed from mid-January until Boston proposed a 100-basis-point increase in late April, approved May 4, 1981.

San Francisco and Atlanta each presented one additional increase proposal but did not resubmit them after they were denied.

The October 1981 to August 1986 Downswing

After May 1981, no proposals were made until, on October 23, 1981, Chicago voted a 100-basis-point reduction. This proposal was tabled on October 26, as was Minneapolis's 50-basis-point cut proposed on October 29. The very next day, however, the 100-basis-point cut was approved. That was the first in

what was to be an extended series of cuts associated with the 1981–82 recession.

Soon after the October cut, Richmond and San Francisco proposed another; their proposal was denied on November 16. By the end of the month, however, three other Banks joined them in proposing a cut and this time the proposals were tabled by the Board of Governors. It was on December 3, 1981, that 10 Banks' reduction proposals were approved. But this was not to become another sequence of quick cuts. The San Francisco Bank immediately proposed a further cut but did not resubmit its proposal after it had been tabled twice. The speed with which sentiment was shifting is illustrated by the fact that by late January 1982, San Francisco and St. Louis were proposing a 100-basis-point *increase*. After their proposals were tabled, they were joined by Richmond and Atlanta. The Banks did not resubmit their requests after they had been tabled on February 22, however, except for St. Louis, which persisted with an interruption until May in asking for an increase. Back in March, Dallas had begun requesting a 100-basis-point reduction and was soon joined by Chicago, which sought a 50-basis-point reduction.

The sharp division of opinion that prevailed in the System is illustrated by the Board of Governors' April 12, 1982 decision to deny Dallas's proposal for a 100-basis-point reduction, Chicago's proposal for a 50-basis-point reduction, and the St. Louis request for a 100-basis-point increase. Dallas dropped out after the denial and St. Louis after its proposal was tabled on May 10, 1982. Reflecting the great uncertainty at the time, requests both to increase and to decrease the discount rate were again tabled on June 30 and July 6, 1982. Despite two Board denials, Chicago persisted in its rate cut proposal for nearly four months, until it was approved on July 19, 1982, the first cut in more than seven months.

The July 19, 1982 decision was a watershed for monetary policy. Four cuts were made in less than two months, and seven cuts in all were made before the end of the year. Chicago clearly led the way by proposing a 50-basis-point cut continually from March through November. After moving in steps of 100 basis points from October 6, 1979 through December 3, 1981, the Board of Governors made all of its cuts in 50-basis-point steps. Similarly, except for one request each of 100 basis points from San Francisco and Dallas, all the proposals for reduction in this period were for 50 basis points. Despite the rapid money growth associated with the nationwide introduction of interest-bearing NOW accounts and, subsequently, of money market deposit accounts, no proposals to increase rates were made after those by Cleveland in late June and early July of 1982. These observations are consistent with the view that the new operating regime introduced on October 6, 1979, which placed greater emphasis on monetary growth, came to an end in the summer or early fall of 1982.

The year 1983 proved to be the first (and only) year since 1972—when wage and price controls were in effect—that the discount rate was not changed. This stability does not imply this period was one without controversy. In early 1983, eight Reserve Banks sought further rate reductions. In March, Richmond sought an increase. In early June, no Bank sought a change, but by early July five wanted a rate increase. And by fall, two Banks were again proposing a reduction. Over the entire year, six Banks had proposed reductions, four had proposed increases, and two had proposed both reductions and increases.

Sentiment from the Board of Governors clearly evolved toward restraint during the year: in January as many as seven requests for reductions were tabled. By spring such requests were denied. Throughout the summer, as many as five requests for increases were tabled but not denied.

In early 1984, after Chicago desisted from nearly four months of recommending reductions, no proposals for change were made. In March, St. Louis and Dallas proposed increases that were tabled, resubmitted, and approved April 6, 1984.

Starting in late May, Cleveland proposed further increases and was soon joined by four other Banks. Most of these proposals were withdrawn after tabling, but St. Louis persisted until its requests had been denied several times. This was to be the last request for an increase until April 1987. In November 1984, two of the Banks that earlier had sought increases (St. Louis and Dallas) were joined by Chicago and San Francisco in proposing a 50-basis-point re-

No critical, magic number of proposals triggers the Board to act on the discount rate—the number has varied from one Bank to all 12 Banks.

duction. That proposal, along with those of three other banks, was approved on November 21, 1984. Not only was the April increase reversed but this cut was followed by another 50-basis-point cut one month later, leaving the rate at the end of 1984 below its level at the start of the year.

The April 6, 1984 increase was the first occasion since July 1971, and the only example in the past 20 years, when the discount rate was changed only once in a particular direction: not only had the April 1984 increase been preceded by a series of nine consecutive cuts, but it was to be followed by a series of seven consecutive cuts. From a broad historical perspective, this single April 1984 increase has been treated here as a temporary aberration within an extended period of declining rates.

Thus, the chronology of four major cycles proposed here ignores the April 1984 increase. An odd "mini cycle" occurred in 1984, within what is here classified as a protracted downswing. This brief reversal within a long sequence of reductions may be related to two factors: (1) the Federal Reserve was operating on a borrowed reserves target regime; and (2) the federal funds market had been subjected to unusual pressure by the failure of a major commercial bank (Continental Illinois). The combination of these two factors had resulted in a sharp increase in the federal funds rate. The minutes of the March 23, 1984 Board of Governors meeting state:

> In the course of the Board's discussion [prior to the approval of the April increase], considerable emphasis was given to the desirability of raising the discount rate in order to bring it into better alignment with market rates. The latter had increased appreciably over the course of recent weeks, and borrowing at the discount window had risen substantially. . . .

Starting in November of 1984 Dallas, which had requested a 100-basis-point increase in July, began issuing a more or less continual series of requests for rate reduction. Thus Dallas was the clear leader, along with San Francisco to a lesser extent, in the series of seven rate reductions that took place between November 1984 and August 1986. Despite the fact that no rate increases were proposed after September 1984, this phase of the downswing was not an entirely smooth one. In early 1986, as many as eight Banks were proposing cuts. All except Dallas and San Francisco eventually withdrew their proposals after repeated tabling by the Board.

On the morning of February 24, 1986, the Board voted (four to three) to approve a reduction. Chairman Volcker voted with the minority, which expressed concern about the impact of the reduction on the foreign exchange value of the dollar. This decision to reduce the discount rate was not implemented, as the Board reconsidered its action later the same day. On March 6, however, 10 days after the controversial vote, a decrease to 7 percent was approved without dissent. The discount rate was reduced three more times in 1986 (April 18, July 10, and August 20). These reductions were led by Dallas and three other Banks.

The September 1987 to February 1989 Upswing

Starting in April 1987, five Banks began requesting increases. In each case their requests were not resubmitted after tabling, not denial, by the Board of Governors.

On August 11, 1987 Alan Greenspan replaced Paul Volcker as chairman of the Federal Reserve Board. At the time, no Reserve Bank was seeking a change in the discount rate. (Dallas's two recent reduction requests had been denied.) Within a week, however, Cleveland proposed a 50-basis-point increase; the proposal was denied, resubmitted, and denied again on August 31. When the Board met again on September 3, "developments in financial markets in recent days [had] suggested that an increase in the discount rate might be appropriate.

The propensity to propose discount rate changes has varied both among Reserve Banks and over time.

Although tentatively favoring a ½ percentage point increase, the [Board] members preferred to defer action on the matter overnight so that they could assess evolving conditions in the bond and foreign markets further." That same day, New York had voted an increase and Cleveland had renewed its proposal to increase; their proposals were approved on September 4, 1987.

This sequence of events illustrates how rapidly conditions can change and how difficult it can be to assign the initiative for change. Cleveland had been seeking an increase for several weeks but its requests were twice denied. Nonetheless, with rapidly chang-

ing circumstances, its proposal, along with New York's, was approved four days after a denial. Having no control over timing, a Reserve Bank needs to recognize that tabling or even denial of a proposal does not preclude its approval in the near future if circumstances change.

The October 1987 stock market crash may have encouraged Dallas to request additional reductions, but no other Bank joined in until San Francisco briefly sought a 25-basis-point reduction, in February 1988. Philadelphia, in April 1988, was the first to propose another increase and by July had been joined by seven other Banks. These requests had been tabled by the Board until July 5, when the requests for a 50-basis-point increase by seven Banks (San Francisco had withdrawn) were denied. Only Cleveland and Atlanta persisted in proposing increases until, after being joined by seven other Banks, their request was eventually approved on August 9. Cleveland soon requested another increase and persisted despite several denials; eventually it even raised its request to 100 basis points. By early 1989, Cleveland had been joined by six other Banks and eleven Banks (all but Dallas) were in at the time an increase was finally approved, on February 24, 1989.

The December 1990 to July 1992 Downswing

In May 1989, Dallas started another series of requests for a rate reduction. These proposals were tabled, and they were joined briefly by one from Chicago in the fall. In early 1990, Cleveland proposed a 50-basis-point increase. By May 1990, San Francisco had joined Cleveland with a 25-basis-point increase proposal, and Dallas had temporarily dropped its reduction requests. Throughout most of the first half of 1990, the Board had been tabling one request for a rate increase and one request for a rate decrease.

In July 1990, after two consecutive denials, Cleveland dropped its increase proposals. Starting in August 1990, the first month of the 1990–91 recession, Dallas continuously requested a 50-basis-point reduction until, after being joined by eight other Banks, the request was approved on December 18, 1990. This is the longest lead time between an original, uninterrupted request and its eventual approval in the entire 20-year period. Dallas, Richmond, and Boston proposed another cut in early 1991, which was approved February 1. Dallas and Boston soon proposed still another cut, which was approved on April 30 along with those of three other Banks. No further requests for change were received until Boston, Cleveland, and Philadelphia sought another cut in August 1991, which was approved September 13. Boston and Cleveland soon sought still another cut and it was approved November 6, 1991. Chicago quickly proposed another reduction and had been joined by four other Banks by December 16, 1991, when their proposals were tabled. Three days later Chicago, along with New York, increased the size of the proposed reduction to 100 basis points and received approval from the Board of Governors.

In February 1992, Boston proposed another reduction in the rate. After the Board tabled the request for four months, Boston did not resubmit its request in June. On June 25, 1992 Chicago voted a 50-basis-point cut, which was tabled June 29, 1992. The Board approved Chicago's request, the only request on the table, on July 2, 1992. The action established a 3 percent discount rate, which has prevailed up until the time of this writing (April 1993).

III. Determinants of Reserve Bank Proposals

A review of the history of discount rate activity and summary statistics over the past 20 years shows a broad similarity but also considerable diversity in the ways the 12 Reserve Banks approach discount rate determination. This section attempts to formalize this observation with a statistical model of discount rate recommendations that incorporates both common and distinctive factors influencing Reserve Banks' discount rate proposals. Under the presumption that the decision to propose a change in the rate, rather than the exact magnitude of the proposed change, is of paramount importance, a logit model is used to estimate how various factors influence the probability of proposing an increase or a decrease in the discount rate.

Logit estimation techniques are used when the dependent variable, in this case the recommended change in the discount rate, is discontinuous. Because recommended changes take on only a few values with any regularity (typically changes of 25 or 50 basis points) the error term, given the values of the independent variables, can take on only a few values. Under these circumstances estimates from an OLS regression would be inefficient. The logit estimation technique transforms the problem to produce efficient estimators. Logit provides an estimate of the probability, relative to no change, that a Reserve Bank will recommend an increase or decrease in the

discount rate. The coefficient of a variable is an estimate of the effect of that independent variable on those probabilities.[6] There are two sets of coefficients for each variable because there are two different policies other than a no change recommendation.

The descriptive statistics and historical account presented above show that all Reserve Banks do not behave identically. At the same time, preliminary attempts to model each Bank separately were unsatisfactory, most probably because of the limited number of change proposals for some Banks. The equations presented in this paper attempt to specify a joint regression for all Banks' recommendations while allowing for individual Bank differences. Specifically, the base regression used assumed that every Bank cared equally about all the independent variables, and that all Banks shared the same coefficients for these variables. This constraint was then relaxed for every variable and every Bank in order to test whether the independent variables actually did identically affect the Banks' discount rate recommendations. When a Bank's coefficient was found to differ significantly from the others', the equation was altered to allow those coefficients to differ.[7] The final results of this search procedure are presented in Table 8.

Thus, the equation described in Table 8 emerged from a fairly extensive "specification search" across 12 Reserve Banks and even more independent variables. Other searchers might well arrive at a somewhat different final equation. In addition, things have changed over time—Boston's distinctive behavior stems solely from the 1973–74 oil shock, as Dallas's does from the collapse in oil prices in 1986—and may well change again. Nevertheless, all of the explanatory equations looked similar to the one reported here. Moreover, the equation in Table 8 was also estimated using the ordered probit technique which ranks policy from tighten, to no change, to loosen. With one exception, the logit results also hold when the ordered probit estimation technique is used.[8]

The results are shown in Table 8. At the most general level, Reserve Banks pay attention to three types of information—labor markets, financial markets, and inflation or monetary aggregates. For all Banks, employment growth was a significant determinant of discount rate proposals. The unemployment rate was also a factor in decisions to propose an increase in the discount rate, though apparently not in those to propose a decrease. In addition, three Banks placed independent weight on labor market conditions in their Districts: Chicago and Atlanta were influenced by regional employment growth, and Chicago and Dallas were influenced by the unemployment rate in their District.

These regional effects may reflect different views of the role of the Reserve Bank in the procedure for setting the discount rate. The typical view is that Banks' proposals are based on their own assessment of national economic conditions, because one rate applies throughout the country. It is also possible to interpret the two-stage process of setting the discount rate another way, however. The Reserve Banks may be viewed as basing their recommendations on what is most appropriate for their District; the role of the Board of Governors, in this view, would be to weigh the grass roots input from the regions in order to form a national policy. Whichever interpretation is correct, it does seem clear that some Reserve Banks do attach independent importance to labor market conditions in their District.

Second, it is clear that all Banks attach importance to developments in the financial markets. Over time, the emphasis appears to have shifted between interest rates and monetary aggregates. Specifically, all Banks placed considerable weight on the growth of the narrow monetary aggregate in the period following the October 1979 change in operating procedures. In the periods both before October 1979 and since 1982, emphasis was also placed on the spread between the federal funds rate and the discount rate. This emphasis accords with the importance attached, in discount rate announcements, to keeping the discount rate "aligned" with other short-term interest rates. The spread seems to have been a more important factor in proposals to increase than for those to decrease, especially in the most recent period.

The most subtle consideration in discount rate proposals is the role of inflation or monetary growth (as a proxy for future inflation). As was true in the

[6] The effect of the independent variable on the probability of changing policy depends on the value of the independent variable; thus, the size of the effect changes as the value of the independent variable changes. As a result, the magnitude of the effect of each variable on the probabilities is traditionally calculated at the mean of the right-hand side variables.

[7] For each variable, each Reserve Bank was sequentially removed from the group to test whether that Bank's coefficient for that variable differed from the rest of the group. If it did, then the variables were changed so that the coefficients could differ. Subsequent Banks were tested to see if they belonged in either group or alone. Because the sequence can matter, alternative sequences were tested, and they generally had no effect on the groupings.

[8] The exception is national payroll employment, which took on the opposite sign. This puzzling result may reflect the collinearity of using several different labor market variables.

Table 8
Determinants of Discount Rate Proposals (RDP), 1973–1992

Variable	Increases	Decreases
N	.33	−.25
	(.05)	(.04)
NR67	.07	−.13
	(.04)	(.05)
UR	−.60	−.001
	(.10)	(.08)
URR711	−.02	.11
	(.04)	(.02)
CPIL58	.08	−.14
	(.04)	(.04)
M1R2	.28	−.38
	(.03)	(.06)
MOR13	.27	.02
	(.05)	(.04)
M5	.26	−.38
	(.08)	(.11)
M8	.37	−.47
	(.08)	(.14)
SPDR1	.36	−.35
	(.10)	(.19)
SPDR3	.72	−.18
	(.12)	(.17)
RDP(−1)	.02	−.04
	(.003)	(.004)
OIL1	−.58	2.69
	(1.05)	(.59)
Constant	−2.95	−1.72
	(.66)	(.64)

Note: Standard errors in parentheses.

RDP: dependent variable; the direction of the change in the discount rate proposed by each District, 0 for no change, 1 for tightening (increase), 2 for loosening (decrease).

N: rate of growth in national payroll employment: 3-month percent change at annual rate.

NR67: corresponding regional employment growth rate for Atlanta(6) and Chicago(7) Districts.

UR: national unemployment rate.

URR711: regional unemployment rate for Chicago(7) and Dallas(11) Districts.

CPIL58: CPI for all Districts except Richmond(5) and St. Louis(8), 12-month growth rate.

M1R2: rate of growth in M1: 3-month percent change at annual rate for the period from 1979:10 to 1982:09, zero otherwise.

MOR13: splice of the 12-month percent change in M1 from 1973:01 to 1979:09, zeros from 1979:10 to 1982:09, and the 12-month percent change in M2 from 1982:10 to 1992:12, for all Districts except Richmond(5) and St. Louis(8).

M5: splice of the 3-year growth rate in M1 from 1973:01 to 1982:09 and the 3-year growth rate in M2 from 1982:10 to 1992:12, only for Richmond(5) District.

M8: same definition as M5, but for St. Louis District(8).

SPDR1: spread between the federal funds rate and the discount rate for the period 1973:01 to 1979:09, zero otherwise.

SPDR3: same spread for the period 1982:10 to 1992:12, zero otherwise.

RDP(−1): the one-month lag in the dependent variable.

OIL1: 1 for Boston from 1973:10 to 1975:03 and 1979:05 to 1980:07, zero otherwise.

case of regional labor market conditions, it seems clear that not all Reserve Banks react to inflation/money growth in the same way. For most Banks, the actual inflation rate was an important factor in determining proposals. For the St. Louis and Richmond Banks, however, a four-year lag of the narrow money stock dominated the actual inflation rate as a determinant of discount rate proposals. This result is consistent with the inflation equation in the St. Louis model, in which inflation depends on a long distributed lag of growth in the narrow money stock. The Richmond Bank also followed a monetarist approach, although the hypothesis that St. Louis and Richmond reacted identically was rejected in a formal statistical test.

Still another distinctive individual Bank feature is Boston's tendency to accommodate the oil price shocks of 1973–74 and 1979. Preliminary experimentation with individual bank dummy variables had revealed an unexplained tendency for Boston to favor rate reduction. Experimentation showed that this tendency was due solely to the 1973–74 oil price episode, described in detail above in connection with Table 5. Addition of an oil price accommodation variable for the 1973–74 and 1979 episodes eliminates Boston's otherwise unexplained proclivity to ease.

Finally, a word of caution on the robustness of these results. This data set is large and complex, and several specification searches were conducted to obtain these results. Thus, strictly speaking, formal statistical tests do not apply. Certainly, the distinctive characteristics of particular Reserve Banks should be taken with a grain of salt. The broad results for the Banks as a group, however, seem to be on a solid footing qualitatively, even if not precise quantitatively.

IV. Determinants of Discount Rate Changes

Setting the discount rate is a two-step process. Most of the discussion to this point has focused on the first step, the discount rate proposals made by the Boards of Directors of the 12 Reserve Banks. Once these proposals from the regional Banks are reviewed, the Board of Governors disposes of them by accepting, denying, or choosing to take no action on them. The information the Board uses to make its determination is presumably essentially the same as that on which the Banks base their proposals. The one additional piece of relevant information the Board has is the Reserve Banks' discount rate propos-

Table 9
Number of Proposals Submitted at Time of Discount Rate Change: Frequency Distribution

Number of Proposals	1973–82 (1)	1983–92 (2)	1973–92 (3)
1	2	1	3
2	5	2	7
3	0	0	0
4	4	0	4
5	4	4	8
6	7	0	7
7	2	6	8
8	6	1	7
9	4	3	7
10	7	0	7
11	2	1	3
12	2	0	2
Number of Discount Rate Changes	45	18	63
Mean Number of Proposals	6.8	6.3	6.6

Source: See Table 1.

Table 10
Discount Rate Changes (RD), 1973–1992

Variable	Increases	Decreases
N	.45	−.41
	(.21)	(.14)
UR	−.90	.04
	(.36)	(.26)
CPI	.09	−.14
	(.14)	(.11)
M1R1	.40	−.42
	(.13)	(.16)
M1R2	.56	−.37
	(.16)	(.16)
M2R3	.04	−.13
	(.22)	(.12)
SPDR3	.94	−2.61
	(.55)	(1.04)
NOP	.20	−.28
	(.09)	(.16)
Constant	−1.19	1.31
	(2.59)	(2.20)

Note: Standard errors in parentheses.

RD: dependent variable; the direction of the one-month change in the discount rate, 0 for no change, 1 for tightening (increase), 2 for loosening (decrease).

N: rate of growth in national payroll employment: 3-month percent change at annual rate.

UR: national unemployment rate.

CPI: 12-month rate of growth in the CPI.

M1R1: rate of growth in M1: 3-month percent change at annual rate for the period from 1973:01 to 1979:09, zero otherwise.

M1R2: rate of growth in M1: 3-month percent change at annual rate for the period from 1979:10 to 1982:09, zero otherwise.

M2R3: 12-month percent change in M2 from 1982:10 to 1992:12, zero otherwise.

SPDR3: spread between the federal funds rate and the discount rate for the period 1982:10 to 1992:12, zero otherwise.

NOP: net number of proposals to increase the discount rate.

als. This section examines what economic information affects the Board's decision to change the discount rate and whether the Bank proposals have an independent impact on the Board's decision.

Table 9 shows the number of Reserve Banks that had submitted proposals to change the discount rate at the time the Board approved a change. (These figures are inclusive, in that they include Banks whose previous change proposal had been denied but whose Directors had not yet met again to offer another proposal.) The table makes clear that no critical, magic number of proposals triggers the Board to act—the number has varied from one Bank (on three occasions) to all 12 Banks (on two occasions). The vast majority of changes (76 percent) were made when four to 10 proposals had been received. The average number of proposals pending (6.6) has varied little over time or between increases and decreases in the discount rate.

When the Board waits until it has received 11 or 12 proposals—as it did for three increases (April 1973, October 1977, and February 1989) and for two decreases (May 1975 and January 1976)—it seems reasonable to regard the regional Banks as the initiators of the change. At the other extreme, when the Board acts on the first proposal received—as it did for the increases in July 1979 and May 1981 and the reduction of July 1992—it is reasonable to think that the Board had been disposed toward the change and was awaiting, or even inviting, a proposal on which to act. On some occasions, these actions may have encouraged Bank proposals, as was clearly the case in the January 1978 increase described in detail earlier.

Because the domestic and foreign trading desks at the New York Bank are in more or less continuous contact with the Board of Governors, it is not surprising that the New York Bank was included in seven of the 10 occasions when only one or two Banks had submitted a proposal at the time of a change. In fact, New York had a proposal pending at the time of a change more often (75 percent of the time) than any

other Bank. Only two other banks participated in more than one of these 10 changes, Boston in one solo and two two-Bank proposals (with New York) and Chicago in one solo and one two-Bank proposal for change. After New York, they were also the two Banks most often with a proposal at the time of change.

The question remains: Do the Reserve Banks' proposals have an independent effect on Board approvals, or does the Board simply respond to the standard economic data? The results are shown in Table 10, which has the same format as Table 8.

The only new variable is the (net) number of Bank proposals (NOP) before the Board. Notice first that employment growth has a significant effect on all changes, while the unemployment rate plays a role only in increases. Inflation influences the decision in the expected direction, but its effect is not significantly different from zero. In contrast, money growth, as measured by M1, had a clearly significant impact. Since 1983, the growth of M2 has not had a significant impact. In contrast, over this latest period, and only in this latest period, the interest rate spread has played a significant role, particularly as a deterrent to reductions.

Finally, these data support the view that Reserve Bank recommendations matter. The number of Banks proposing to change the discount rate has had a clear influence on the decisions to increase and a probable, though less precisely measured, impact on the decision to reduce the rate. In contrast to the results in section III, essentially these same results emerged from a variety of specifications of the equation, so only the most reasonable one is reported in Table 10.

V. Summary and Conclusions

A voluminous literature has developed on open market operations, while scant attention has been paid to the process by which the discount rate is set. The discount rate is determined in a two-way interaction between proposals by the boards of directors of the Reserve Banks and disposition of their proposals by the Board of Governors.

A review of the evidence over the past 20 years clearly reveals that the Reserve Banks interpret their discount rate responsibilities differently. Banks differ in their activism: for example, over the last 10 years, Dallas has proposed to change the rate more than 40 percent of the time, whereas Kansas City and Minneapolis preferred a different rate less than 10 percent of the time. Banks differ also in how quickly they propose change. Chicago has most frequently been the first Reserve Bank to propose a change in the discount rate, whereas Richmond has seldom been the first. Banks also differ in their persistence in seeking change. Chicago and Dallas, relatively activist Reserve Banks, also frequently discontinued their proposals, whereas New York and especially Boston tend to stick with their proposals once they have been made.

Reserve Banks also appear to attach differing importance to the policy goals, and they seem to use different information sets or "models" in determining how best to reach those goals. For example, all Banks' behavior is influenced by inflation or monetary growth (perhaps as an indicator of future inflation), and by labor market conditions (perhaps as another indicator of future inflation). But individual characteristics also stand out. The St. Louis Bank apparently pays more attention to longer-term monetary growth trends than other Banks do. Dallas's behavior seems to have been influenced by the unemployment rate in that District, at least in the period since the 1986 oil price decline. Boston alone interpreted the 1973 explosion in oil prices as a contractionary shock, whose one-time price level effect should be accommodated.

The data suggest that Reserve Bank recommendations have an independent influence on Board decisions regarding the discount rate.

A particularly interesting set of proposals are those that proved in retrospect to be "out of sync" or in the opposite direction from the actual change that the Board of Governors eventually approved. Every Reserve Bank has made at least two such proposals, but several of these proposals can be justified, even in retrospect, as "correct" or at least defensible. The clearest example may be in early 1980 when 11 banks sought to raise the discount rate, seven proposing 15 percent. Although the basic rate was not raised, a surcharge on large banks was imposed so that these proposals were in a substantive sense adopted and thus not really out of sync. More controversial were proposals in 1973 and 1983 that were out of sync with

the next change but in the same direction as a long series of subsequent changes. It is easy to argue that these proposals were especially farsighted or, at a minimum, that their adoption would not have greatly altered the long-run course of economic history. Most common were proposals to extend a series of changes in one direction one step further than it actually was extended—in essence, a matter of timing. Most difficult to defend are those proposals to change that were both preceded and followed by changes in the opposite direction. Such proposals were put forward by five Banks in 1982, two Banks in 1988, and one Bank in 1975. In such cases, more is at issue than simply timing.

Both historical and statistical analyses reveal changes in discount rate behavior, timing, and diversity among Reserve Banks. All banks clearly were influenced by M1 growth in the two-year period following the October 6, 1979 change in the Federal Reserve's operating procedures. In contrast, Banks differ in the importance they have attached to money growth, both before and since. Similarly, the spread between the federal funds rate and the discount rate has recently taken on an importance that it did not have in earlier years, especially with regard to discount rate reductions.

The fundamental, though perhaps not surprising, result is that the number of Reserve Bank proposals before the Board of Governors does have an effect on their discount rate decision, above and beyond national economic conditions. This result suggests that discount rate determination is in practice a two-stage process in which the District-level input plays an independent role.

References

Cook, Timothy and Thomas Hahn. 1988. "The Information Content of Discount Rate Announcements and Their Effect on Market Interest Rates." *Journal of Money, Credit and Banking*, vol. 20, no. 2 (May), pp. 167–80.

Dueker, Michael J. 1992. "The Response of Market Interest Rates to Discount Rate Changes." Federal Reserve Bank of St. Louis *Review*, July/August, pp. 78–91.

Poole, William. 1990. "The Discount Window." In Thomas Mayer, ed., *The Political Economy of American Monetary Policy*, pp. 255–68. Cambridge: Cambridge University Press.

Roley, V. Vance and Rick Troll. 1984. "The Impact of Discount Rate Changes on Market Interest Rates." Federal Reserve Bank of Kansas City *Economic Review*, January, pp. 27–39.

Smirlock, Michael and Jess Yawitz. 1985. "Asset Returns, Discount Rate Changes, and Market Efficiency." *Journal of Finance*, vol. 40 (September), pp. 1141–58.

Wagster, John. 1993. "The Information Content of Discount Rate Announcements Revisited." *Journal of Money, Credit and Banking*, vol. 25, no. 1 (February), pp. 132–37.

Interest Rate Structure and the Credit Risk of Swaps

Katerina Simons

Economist, Federal Reserve Bank of Boston. *The author wishes to thank Richard Kopcke for helpful suggestions. Michael Jud provided valuable research assistance.*

As the market for swaps grows and matures, understanding and measuring the accompanying credit risk remains a concern of bankers, regulators, and corporate users. Swaps have grown explosively in the last decade. At the end of 1982, the aggregate of contracts outstanding was $5 billion. By the end of 1991, contracts outstanding exceeded $4.6 trillion.

In the most general terms, a swap is an agreement between two parties to exchange interest payments for a period of time. While there are many different kinds of swap contracts, they fall into two general categories, interest rate and currency swaps. Interest rate swaps account for most of swap volume, exceeding $3 trillion in 1991.

The first and most popular use of swaps is to transform fixed-rate debt into floating-rate debt, and vice versa. While this can be accomplished with the help of other instruments, such as forward contracts and financial futures and options, swaps offer advantages in the form of greater flexibility and longer maturity, often extending to as long as 10 years. The birth of swaps in the early 1980s can be traced to the financial turbulence at that time and the resulting high volatility of interest rates. High volatility led many borrowers to value more than ever the stability and security of fixed-rate debt, at a time when the capital markets offered it only at an increasingly high premium. This spurred a variety of financial innovations, of which the interest-rate swap was, perhaps, the most important.

When the swap market was in its infancy, firms had to find counterparties with matching needs. Now this is not necessary, because many commercial and investment banks make markets in swaps. This activity allows them to earn income but also exposes these banks to credit risk, that is, the risk of nonperformance by the counterparty. Credit risk of swaps remains a concern and fuels continuing debates about the best ways to measure and price it, and about the appropriate amount of capital that should be set aside to cover possible losses.

One popular method of analyzing the credit risk of swaps is based on Monte Carlo simulations of the future course of interest rates. The use of simulations in this context was popularized by a Bank of England study, which formed the basis for the development of capital requirements for swaps under the Basle Accord. That study, and those that followed it (ISDA 1987; Simons 1989) shared the same basic simulation methodology, estimating the credit exposure on matched pairs of swaps under thousands of hypothetical interest rate scenarios. This study builds on the previous work by incorporating into these hypothetical scenarios an interest rate forecast implicit in the prevailing interest rate structure. It finds that if interest rates are expected to rise in the future, the credit risk of swaps is greater.

Section I of this article begins with a brief history of the swap market, discusses the mechanics of a "plain vanilla" interest rate swap, and describes how changes in interest rates give rise to credit risk. Section II discusses the theories of the term structure of interest rates and calculates the future interest rates implied by a rising term structure. Section III describes the Monte Carlo simulations of hypothetical interest rate scenarios and how they can be used to estimate the potential credit risk of swaps. Section IV incorporates the implicit interest rate forecast into the model and compares the swap credit risk that arises under the flat interest rate structure to the risk implied by rising future rates. The study finds that rising future interest rates result in higher credit risk than flat interest rates. The article concludes with a discussion of the capital requirements for swaps recently implemented by bank regulators and the various modifications to the plain vanilla swap that have been developed in the market to limit credit risk of swaps.

Table 1
Interest Rate Swaps: Outstanding Notional Principal as of December 31, 1991

Currency	U.S. Dollar Equivalent (Millions)	End User (Percent)	Dealer (Percent)	Rank
U.S. Dollar	1,505,995	55.2	44.8	1
Japanese Yen	478,923	44.7	55.3	2
Deutsche Mark	263,411	57.8	42.2	3
British Sterling	253,516	58.1	41.9	4
Swiss Franc	137,620	53.0	47.0	5
French Franc	115,607	85.7	14.3	6
European Currency Unit	72,822	58.4	41.6	7
Australian Dollar	72,339	76.9	23.1	8
Canadian Dollar	61,335	67.3	32.7	9
Italian Lira	34,321	60.2	39.8	10
Dutch Guilder	18,742	44.2	55.8	11
Swedish Krona	18,233	84.0	16.0	12
Other Currencies	17,550	68.1	31.9	13
Belgian Franc	7,523	76.5	23.5	14
New Zealand Dollar	3,399	81.4	18.6	15
Hong Kong Dollar	2,821	56.5	43.5	16
Danish Krone	908	63.1	36.9	17
Total	3,065,065	56.2	43.8	

Source: International Swap Dealers Association, Market Survey, supplied by International Swap Dealers Association.

I. A "Plain Vanilla" Swap

The simplest and most common type of swap, the plain vanilla swap, consists of an exchange between two counterparties of fixed-rate interest for floating-rate interest in the same currency. The principal amount upon which these interest payments are based, called "notional principal," is not exchanged.

Table 1 shows the 1991 dollar equivalent of the total notional principal of interest rate swap contracts. The U.S. dollar is by far the most popular currency, accounting for $1.5 trillion of the $3 trillion interest-rate swap market. While a few swaps had been arranged in the United States in the late 1970s, the first major domestic interest rate swap is usually credited to a 1982 transaction between the Student Loan Marketing Association (Sally Mae) and IT&T Financial Corporation (Wishon and Chevalier 1985). Sallie Mae had issued $100 million of intermediate-term fixed-rate debt, while IT&T had more than $100 million in commercial paper outstanding, which it was rolling over every 90 days. Sallie Mae and IT&T entered into an interest rate swap, exchanging interest payments on $100 million, with Sallie Mae paying IT&T floating-rate and IT&T paying Sallie Mae fixed-rate in return. This gave both companies a better match with their assets, because Sallie Mae had a portfolio consisting mostly of floating-rate assets, while IT&T had a portfolio consisting mostly of fixed-rate assets.

Sallie Mae and IT&T could have simply issued debt that matched their assets, but both companies found that the swap reduced their cost of funds. Sallie Mae, as a government-chartered entity whose debt enjoys an implied government guarantee, could obtain long-term funding at a lower interest rate than

IT&T. At the same time, for short-term funding, Sallie Mae's advantage over IT&T was negligible. Thus, Sallie Mae's comparative advantage in the long-term market meant that the two companies could profitably trade, or swap, their interest payments, and both could save on borrowing costs. The transaction attracted considerable attention and was widely imitated, because the comparative advantage of higher-rated borrowers over lower-rated borrowers in the long-term market turned out to be an almost universal phenomenon.

To look at this comparative advantage in more detail, consider a hypothetical swap transaction between a commercial bank (Bank A) and a manufacturing firm (Company B). Bank A is a highly rated institution that can obtain fixed-rate debt at a relatively low rate but prefers floating-rate debt to match the short-term assets in its portfolio. Company B, on the other hand, has a low credit rating and wants to obtain fixed-rate funding. Table 2 illustrates what their borrowing costs might be without the swap.

Because of its higher rating, Bank A can obtain funding more cheaply than Company B in either market, but it has a comparative advantage in the fixed-rate market. It can borrow at a fixed rate at 1.5 percent less than the fixed rate available to Company B, while in the floating-rate market its advantage is only 0.5 percent.

Both parties can realize savings from an interest rate swap. As illustrated in Figure 1, Bank A can borrow at a fixed rate of 7 percent, while Company B can borrow at a variable rate of LIBOR (London Interbank Offer Rate) + 0.5 percent. In a swap, the bank might pay the company LIBOR − 0.5 percent, while the company pays the bank 7 percent fixed interest, which would exactly cover the bank's expense on its fixed-rate borrowing.

In this example, the "gains from trade" made possible by the swap are shared equally by the two counterparties. The bank's overall interest rate with the swap is LIBOR − 0.5 percent, compared to LIBOR without the swap. Company B's overall borrowing cost is 8 percent (7 percent plus 1 percent, which is the difference between LIBOR + 0.5 percent and LIBOR − 0.5 percent), compared to 8.5 percent without the swap. Each counterparty has saved one-half of 1 percent in borrowing costs through the swap.

Credit market arbitrage such as described above is no longer the only use of swaps. Swaps are frequently employed by financial institutions for the management of interest rate risk. Large banks also act as intermediaries in matched transactions. In this case, the bank arranges swaps with two parties simultaneously, acting as the fixed-rate payer in one contract and the floating-rate payer in the other. In practice, most intermediaries now act as market-makers, entering into an agreement with one party in anticipation of locating a matching counterparty, and earning income from a bid-ask spread. Thus, it is no longer necessary for a prospective swap user to search for a counterparty with complementary needs. One need only call a swap dealer to obtain a price quote for a swap of desired maturity. The market for plain vanilla swaps is standardized and highly competitive, so that price quotes from various dealers are likely to be very similar.

Table 2
Comparison of Borrowing Costs without a Swap
Percent

	Bank A	Company B	Relative Advantage
Credit Rating	AAA	BBB	
Fixed Rate	7.0	8.5	1.5
Floating Rate	LIBOR	LIBOR + .5	.5
Possible Savings 1.5 − .5 = 1.0			

LIBOR: London Interbank Offer Rate.

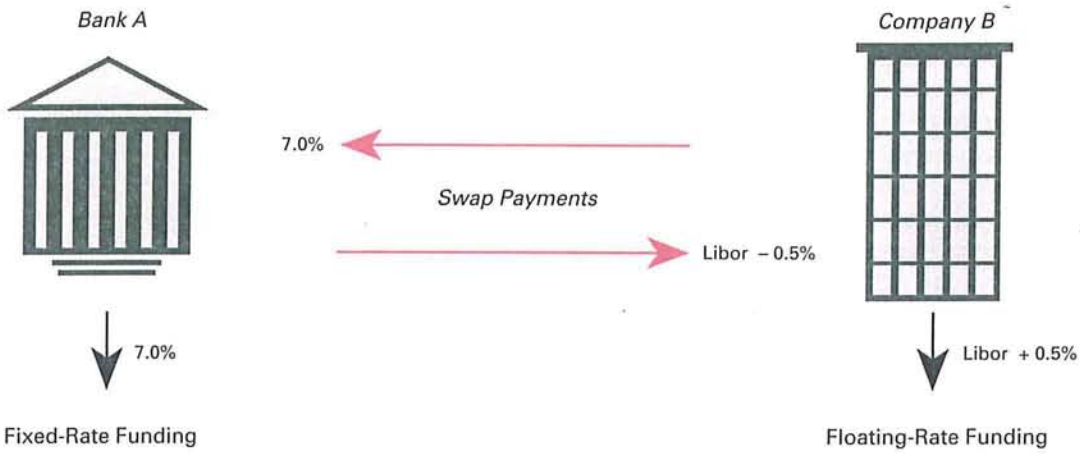
The Pricing of Swaps

Swap dealers quote a floating rate and a fixed rate. The most popular floating rate is either 3-month LIBOR, paid and reset quarterly, or 6-month LIBOR, paid and reset semiannually. LIBOR is usually quoted "flat," that is, without a premium or a discount. The fixed side of the swap is priced relative to the yield on U.S. Treasury securities of equivalent maturity. For example, the fixed rate for a 5-year swap would be the yield on 5-year Treasury notes plus a premium. The premium will differ depending on whether one wants to be a fixed or a floating payer in the swap, reflecting the bid-ask spread required by the dealer. Thus, the 5-year swap might be quoted at 30–33, meaning that the dealer will pay fixed at a 30-basis-point (0.3 percent) premium above the 5-year Treasury yield, or receive fixed at a 33-basis-point premium over that yield.

Unlike interest rates on loans and bonds, swap rates do not vary with the creditworthiness of the

Figure 1

Savings from an Interest Rate Swap



counterparty. Rather, counterparties not deemed sufficiently creditworthy may be required to post collateral or refused the swap altogether.

Table 3 provides an illustration of actual swap rates quoted on September 2, 1992. Perhaps the most striking feature of the swap rates shown are the differences between the fixed and the floating rates and among the rates for various maturities. A fixed-rate payer on a 10-year swap with a notional principal of $10 million (a fairly typical size) would have to pay the floating-rate counterparty $33,800 a year (the difference between the 10-year rate of 6.88 percent and the 3-month LIBOR of 3.5 percent), at least until the floating rates change.

The credit risk of swaps relates only to the cash flows exchanged by the counterparties and does not involve the underlying notional principal. Credit risk arises only when one counterparty defaults—fails to make the agreed-upon interest payments—and interest rates have changed, so that the other party can arrange a new swap only at inferior terms. Default alone does not expose the participants to loss: counterparty B is not obligated to fulfill its side of the transaction if counterparty A defaults. And in the absence of a change in interest rates, presumably counterparty B can negotiate a new swap arrange-

Table 3

Swap Rates on September 2, 1992

Floating Rates	LIBOR (Percent)
3-Month	3.5
6-Month	3.5625
12-Month	3.6875

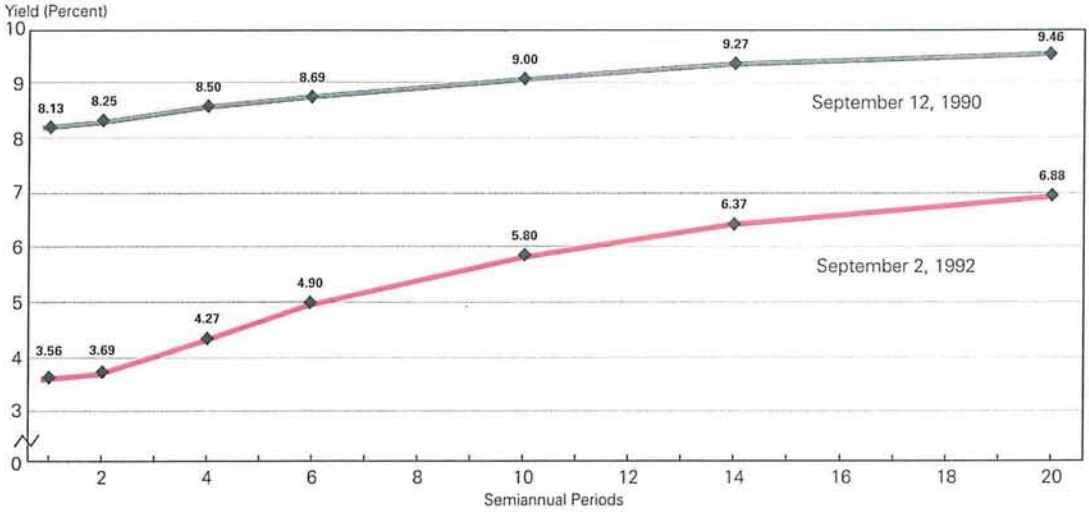
Fixed Rates		Interest Rate Swaps (Basis Points)	Underlying Treasury Yield Curve (Percent)	Actual Rates Paid/Received (Percent)
2-Year	Ask	.21	4.09	4.30
	Bid	.18	4.09	4.27
3-Year	Ask	.35	4.57	4.92
	Bid	.31	4.57	4.88
5-Year	Ask	.33	5.50	5.83
	Bid	.30	5.50	5.80
7-Year	Ask	.37	6.03	6.40
	Bid	.34	6.03	6.37
10-Year	Ask	.38	6.53	6.91
	Bid	.35	6.53	6.88

Rates are as of 1 p.m. New York. LIBOR rates are on an annualized money market basis. Swap rates are on a semi-annual bond equivalent basis.

Source: *American Banker*; Manufacturers Hanover Trust Co.; Fulton Prebon, New York.

Figure 2

LIBOR Swap Yield Curves



Source: *American Banker*, Manufacturers Hanover Trust Co., Fulton Prebon, New York.

ment on the same terms as the old. If interest rates change, however, it may not be possible to replace the swap on comparable terms, and B may experience a loss relative to its experience had A not defaulted.

The whole structure of interest rates on swaps of various maturities, the swap yield curve, is relevant to expectations of future interest rates and thus to the credit exposures on a swap portfolio. The next section will consider the yield curve and its implications for future rates.

II. The Yield Curve

The yield curve is a graph that shows yields to maturity as a function of the instrument's maturity. Figure 2 plots the swap yield curve based on the September 2, 1992 swap yields reported in Table 3. For comparison, Figure 2 also shows the swap yield curve that prevailed almost two years earlier, on September 12, 1990. The chart makes clear that in this two-year period, not only has the level of interest rates fallen dramatically but the yield curve has become much steeper, with the long-term rates exceeding the short-term rates by an unusually large margin.

The yield curve is usually upward-sloping, although at times it has been flat or even inverted, with short-term rates exceeding long-term rates. The unusually steep yield curve prevailing in the past two years has attracted considerable attention and renewed interest in what determines its slope. Two theories attempt to explain the differences in interest rates among instruments of different maturities and the resulting shape of the yield curve.

The first is the expectations theory of interest rate structure, which ascribes the differences in rates across maturities to expectations about future interest rates. In its most basic form, it postulates that the interest rate on a long-term instrument will equal an average of short-term rates expected to prevail over the life of the long-term instrument.

According to the expectations theory, if, for example, 10-year Treasury bonds have a higher yield than 1-year Treasury bills, it is because nominal bill rates are expected to be higher 10 years from now than they are today. Therefore, the yield on a 10-year Treasury bond is an "average" of the successive 1-year rates expected to prevail throughout the 10 years. Similarly, if the yield curve is inverted and the long-term rate is lower than the short-term rate, it is because short-term rates are expected to fall in the

future. The expectations theory allows us to derive the rates that are expected to prevail at various times in the future from the current structure of interest rates.

The expectations theory assumes that instruments of different maturities are perfect substitutes, so that investors are indifferent between holding a long-term bond and rolling over a short-term bond over the same period, assuming they can get the same return. In order to unambiguously infer forecasts of future short-term rates from the slope of the yield curve, it is also necessary to assume that investors' expectations are homogeneous.

The second theory, known as the "preferred habitat" theory of interest-rate structure, provides an important qualification of the expectations hypothesis. This second theory maintains that various groups of securities issuers, on the one hand, and investors, on the other, have their own preferred instruments or maturities (habitats), and that supply and demand from these groups govern the premiums that must be paid for funds at different maturities. For example, life insurance companies may prefer to invest in securities with long maturities because these securities match their long-term liabilities. Banks, on the other hand, usually have liabilities with shorter average maturities, and so may be more reluctant to invest in securities with maturities longer than two or three years.

Swaps of higher maturity reach higher lifetime credit exposures, and a rising interest rate pattern results in higher exposure than a random walk without a trend.

The preferred habitat view regards sums of money invested at different maturities as separate commodities and sees changes in their prices (interest rates) as resulting from shifts in supply and demand, just like changes in relative prices for any other goods. Because long-term securities are generally less attractive to the majority of investors than short-term securities, one consequence of this theory is that the term structure will contain a term premium, making the yield curve upward-sloping. Thus, according to this view, the upward slope of the yield curve resulting from the term premium does not necessarily mean that investors expect short-term rates to rise in the future, but may simply mean that more investors prefer shorter maturities to longer ones. Nevertheless, one crucial insight from the expectations theory still holds, namely, if the term premium is constant over time and relative supply and demand for the various instruments do not change, then a change in the slope of the yield curve signals a change in expectations about future rates.

Figure 3 shows the historical accuracy of the yield curve forecast as exemplified by the yield on 5-year Treasury securities.[1] The dashed line shows the yield on 5-year Treasuries, while the solid line shows the average yield on 1-year Treasuries over the following five years. If the yield curve contained an accurate forecast, the solid and the dashed lines would coincide. In reality, the yields on 5-year Treasuries tend to underestimate the future yields on 1-year Treasuries when rates are rising and overestimate them when rates are falling.

Several academic studies have empirically tested the accuracy of the yield curve forecasts for various time horizons. Their evidence suggests that the yield curve has a statistically significant forecasting capability for short-term rate changes over long time horizons, but forecasts poorly for time horizons of more than a few months but less than a year (Mishkin 1990). This suggests that while one need not slavishly follow the yield curve forecast, whether for estimating credit exposures on swaps or for any other purpose, one should at least be aware of it and any differences from one's own forecast. A detailed discussion of interest rate forecasting and the appropriate weight that forecasting models should give to the yield curve are outside the scope of this article. Instead, the article considers two opposite extreme cases: 1) where the interest rate follows a flat path without a trend and 2) where the yield curve completely determines the future trend in interest rates.

Table 4 calculates the expected future interest rates that are implied by the sample swap yield curve

[1] While we are concerned with predictive powers of the swap yield curve, here we are limited to the evidence from the Treasury yield curve. Swaps are a relatively recent phenomenon, and a time series of swap rates of several decades' duration is not available. In practice the difference is not important, however. Fixed rates on swaps are customarily quoted as premiums over Treasuries of comparable maturities. (The floating rate is usually quoted in terms of the 3- or 6-month LIBOR—London Interbank Offer Rate.) Thus, for maturities greater than one year, the swap yield curve is reflected in the Treasury yield curve.

Figure 3

Yield on 5-Year Treasuries versus the Subsequent Average Yield on 1-Year Treasuries over Five Years

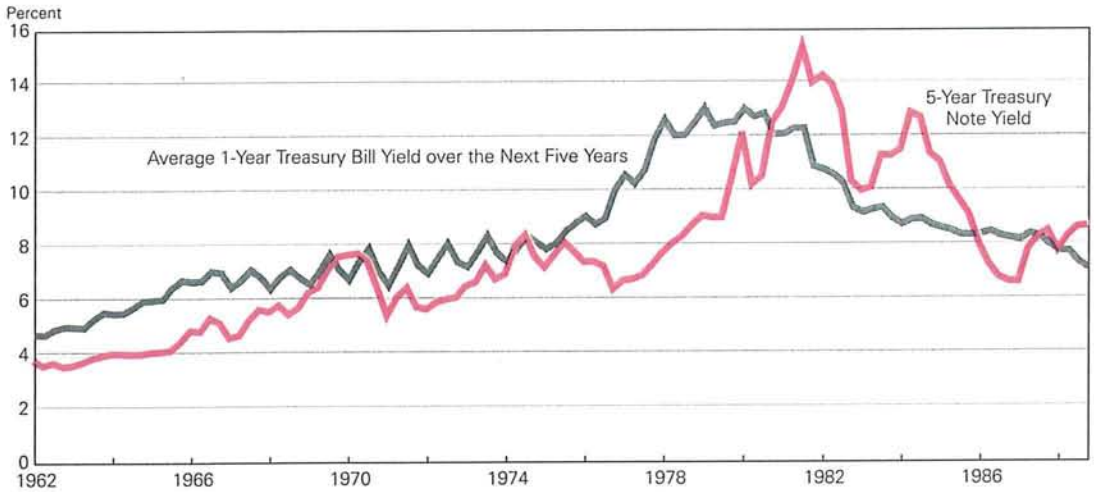


Chart provided by Richard Kopcke.
Source: Board of Governors of the Federal Reserve System.

of September 2, 1992, shown previously in Figure 2. Table 4 shows actual quoted swap rates for the standard maturities, namely 6 months and 1, 3, 5, 7, and 10 years. The 6-month and 1-year rates are LIBOR, while the others are Treasury yields plus a premium. All other swap rates were calculated by interpolating a straight line between the quoted rates. The 6-month forward rates are the rates expected to prevail in each subsequent 6-month period as implied by this yield curve. The calculation of the forward rates from the yield curve is described in the Appendix.

The steeply rising yield curve used in this example implies that short-term rates will rise sharply in the future. It implies, for instance, that the 6-month rate will rise from 3.563 percent in the initial period to 7.847 percent in five years and to 8.508 percent in 10 years.

Table 4
LIBOR Swap Yield Curve and Expected 6-Month Rates

Semiannual Periods	Years	Swap Yields September 2, 1992 (Percent)	6-Month Forward Rate (Percent)
1	.5	3.563	
2	1.0	3.688	3.813
3	1.5	3.979	4.564
4	2.0	4.270	5.149
5	2.5	4.585	5.855
6	3.0	4.900	6.489
7	3.5	5.125	6.485
8	4.0	5.350	6.939
9	4.5	5.575	7.392
10	5.0	5.800	7.847
11	5.5	5.943	7.378
12	6.0	6.085	7.665
13	6.5	6.228	7.953
14	7.0	6.370	8.240
15	7.5	6.455	7.652
16	8.0	6.540	7.823
17	8.5	6.625	7.994
18	9.0	6.710	8.165
19	9.5	6.795	8.337
20	10.0	6.880	8.508

Source: See the text.

III. Monte Carlo Simulations

Relying on forward rates implied by the yield curve is only one approach to forecasting future interest rates. A popular alternative approach is simulating the future path of interest rates as a random walk. The most commonly used models for interest

rate behavior over time rely on random walks based on normal and lognormal distributions, with the lognormal distribution having more desirable statistical properties over longer time periods.[2] The lognormal distribution can be described by the following formula:

$$r_j = r_{j-1} * e^x \tag{1}$$

where x is normally distributed with a mean of zero and a standard deviation based on the historical volatility of interest rates.[3] This distribution gives the generated rate certain important underlying characteristics. First, any changes in the rate are independent of any previous changes in the rate. Second, the rate has no upward or downward trend—it is equally likely to rise and to fall. More specifically, for the lognormal distribution, the rate has an equal chance of doubling or halving over a period of time. Thus, a rate that starts at 10 percent will be equally likely to move to 20 percent or to 5 percent.

These assumptions may be acceptable when the interest rate structure is flat, but when the yield curve slopes up or down, they fly in the face of the expected future rates it implies. It is, however, fairly simple to reconcile the two approaches by incorporating the trend inherent in the yield curve into the random walk generated by a lognormal distribution of interest rates. The easiest way to do this is by adding a constant term to each step of the rate-generating process described by Equation (1), as follows:

$$r_j = c + r_{j-1} * e^x. \tag{2}$$

The constant term "c" can be chosen such that in the absence of random rate movements, that is, when $x = 0$, the rates would follow the path predicted by the yield curve.

Simulating Swap Exposures

The analysis reported here compared 1) the swap exposures resulting from changes in interest rates based on a simple random walk generated by the lognormal distribution, with 2) the swap exposures resulting from random changes in the interest rate around the upward trend in rates embedded in the yield curve. In both cases, the analysis was done using a matched pair of swaps, where an intermediary (usually a commercial or an investment bank) enters into one swap paying the fixed rate, and into an offsetting swap paying a floating rate. As mentioned previously, the intermediary will earn income through the bid-ask spread, while incurring credit risk of default by one of the counterparties.

Since the swaps are assumed to be matched pairs, only one swap of the pair can have positive market value at any one time. That positive market value is the replacement cost, should the counterparty default. All swaps are assumed to be entered into at par and thus have a replacement cost of zero at the outset. But as the interest rate either increases or decreases relative to the original rate, one swap of the matched pair acquires positive market value. The swap is valued in the same way as a bond with a fixed semiannual coupon. The value is determined by the difference between the original fixed rate and the fixed rate currently prevailing for a swap of comparable remaining maturity. (For simplicity, the counterparties are assumed to exchange interest payments at the same time and the swap is valued in each semiannual period right after the exchange of interest. Thus, the analysis abstracts from the settlement risk or accrued interest.)

For a swap to result in a loss, two events must occur: the swap must be costly to replace, and the counterparty must default.

For example, suppose a bank enters into a matched pair of swaps with counterparties A and B, where the bank pays fixed rate in its swap with A and receives fixed rate in its swap with B. Suppose also that each swap has a notional principal of $10 million,

[2] A popular alternative to the lognormal distribution is a "mean reversion process." It assumes that a certain "natural" level of interest rates would prevail in the economy over the long run, and if the simulated rate deviates significantly from the natural rate, it will be more likely to return to it than to keep drifting at random. The relative merits of the various statistical models for interest rate behavior are discussed more fully in the Bank of England study (Board of Governors of the Federal Reserve System and Bank of England 1987).

[3] The historical volatilities of interest rates used in the simulations reported in this study were calculated by the International Swap Dealers Association (1987). The calculations were based on monthly differences of daily observations between January 1979 and March 1987. The resulting annualized volatilities for swaps of different maturities were as follows:

Swap Maturity	10-yr.	7-yr.	5-yr.	3-yr.	1-yr.
Volatility	.142	.148	.160	.166	.195

a maturity of 10 years, and a fixed interest rate of 7 percent. (In reality, as we have seen before, the bank will receive a slightly higher fixed rate than it pays out but we will ignore that for simplicity.) Suppose that two years after the swaps were put on the books, the prevailing fixed interest rate at which they could be replaced has risen to 8 percent. Assuming semiannual settlement dates, the market value of the bank's swap with counterparty A is equal to the present value of a stream of cash flows of $50,000: (8%–7%) * $10 million/2 for 16 semiannual periods (the swap now has 8 years left till maturity). If these cash flows are discounted at a semiannual discount rate of 4 percent (half of 8 percent), the present value of the bank's swap with A is $582,615, or 5.8 percent of the notional principal of the swap.

Following the same logic, the market value of the bank's swap with counterparty B is −$582,615 and exactly offsets the market value of the swap with A, so that the bank is insulated from interest-rate or market risk. The bank is not, however, insulated against credit risk. Should counterparty A go bankrupt and default on its swap contract, the bank's loss would equal the replacement cost of the swap, or $582,615. Counterparty B, on the other hand, being in a profitable position on its swap contract, is extremely unlikely to default. Even if B went bankrupt it would continue to perform on this profitable swap. Therefore, the bank's credit exposure to B is zero and the negative market value of the contract does not offset the positive credit exposure to A.

The simulations here were performed for matched pairs of swaps of 10-year, 7-year, 5-year, 3-year, and 1-year maturities. For each matched pair, the starting interest point for the interest-rate simulations was the rate quoted for that maturity on the sample date, namely September 2, 1992. These rates were used as a starting point both for the rising interest rate path predicted by the yield curve and for the purely random interest rate path. Thus, to use a matched pair of 10-year swaps as an example, a random string of 20 semiannual rates is generated, starting with the initial rate of 6.88 percent. This random generation of a string of 20 rates is repeated 5,000 times. For each of the 5,000 generated interest rate paths, the market value of the swap in each semiannual period is calculated.

Market values generated in this way are then discounted to their present values. The discount rate appropriate for each semiannual period being discounted is the interest rate for the corresponding term dictated by the original yield curve. For example, the market value the swap will attain two years from origination is discounted by the 2-year rate, the value it will attain five years from origination is discounted by the 5-year rate, and so on. When the yield curve is upward-sloping, this means that the value in each subsequent semiannual period is discounted at a higher rate and is thus given less weight in calculating the total lifetime credit exposure of the swap. Of course, when the yield curve is flat, this discounting method means that the value of the swap in each semiannual period is discounted by exactly the same rate, that is, the rate at which the swap was originated.

While other discounting methods are certainly possible, this one seems the most intuitively appealing. If the purpose of the simulation exercise is to estimate the appropriate amount of capital to be set aside at origination of the swap against future credit risk, then this capital can be invested at origination and allowed to earn interest until the time it is needed. If, for example, the capital will be needed two years from origination, it can be thought of as being invested at origination for two years at the 2-year rate prevailing at that time, not at some other rate that may prevail in the future.

The discounted market values generated for each semiannual period are then averaged across the 5,000 iterations of the interest rate path, resulting, for example, in 20 credit exposures for a pair of 10-year swaps. In addition, an average *lifetime* exposure is generated for each swap, which is an average of all the semiannual exposures the swap attains in its lifetime.

To the extent that swaps replace on-balance-sheet obligations of counterparties, they reduce rather than increase the credit risk in the financial system.

IV. Results

Figure 4 graphs the discounted expected credit exposures in semiannual intervals for matched pairs of simple fixed-floating interest rate swaps of various maturities. The horizontal axis shows time in semi-

Table 5
Discounted Average Lifetime Exposure on a Matched Pair of Swaps as a Percentage of Notional Principal
Percent

	10-Year		7-Year		5-Year		3-Year		1-Year	
Swap Maturity	Flat Rate	Rising Rate	Flat Rate	Rising Rate	Flat Rate	Rising Rate	Flat Rate	Rising Rate	Flat Rate	Rising Rate
Confidence Limit										
99%	11.22	13.07	7.78	9.49	5.12	6.44	2.25	2.79	.34	.36
95%	8.28	9.24	5.67	6.79	3.59	4.64	1.63	2.02	.24	.25
90%	6.93	7.57	4.71	5.54	3.06	3.75	1.37	1.66	.20	.21
75%	5.12	5.33	3.37	3.75	2.22	2.54	.98	1.13	.14	.14
Mean Expected Lifetime Exposure	4.03	4.27	2.68	2.97	1.74	2.00	.77	.87	.10	.10

annual periods. The vertical axis shows credit exposure as a share of notional principal. The solid lines plot the time path of the credit exposure that results from an interest rate path based on a pure random walk from the lognormal distribution, ignoring the market forecast of future rates. The dashed lines show credit exposure that results from the rising path of interest rates based on the lognormal random walk with the built-in trend that reflects the market forecast of future rates.

The plots reveal several interesting patterns. First, they have a characteristic inverted bowl shape. The exposure is zero at the start since the swaps were put on at par and can be replaced at no cost. Then, as the fixed rate has a chance to diverge from the initial rate, the exposure gradually increases. As the swap approaches maturity, the exposure starts to decline, since fewer and fewer periods remain in which the difference between the initial and the current rates can accumulate. This basic pattern of gradually increasing, then declining exposure holds for all swaps that are entered into at par, regardless of maturity and the level of the initial interest rate.

Second, the longer the swap maturity, the higher the credit exposure will eventually become, because the rates have a longer time to deviate from the initial rates. And third, the upward-sloping yield curve results in higher exposures than a flat yield curve, and the difference in exposure increases with the swap maturity.

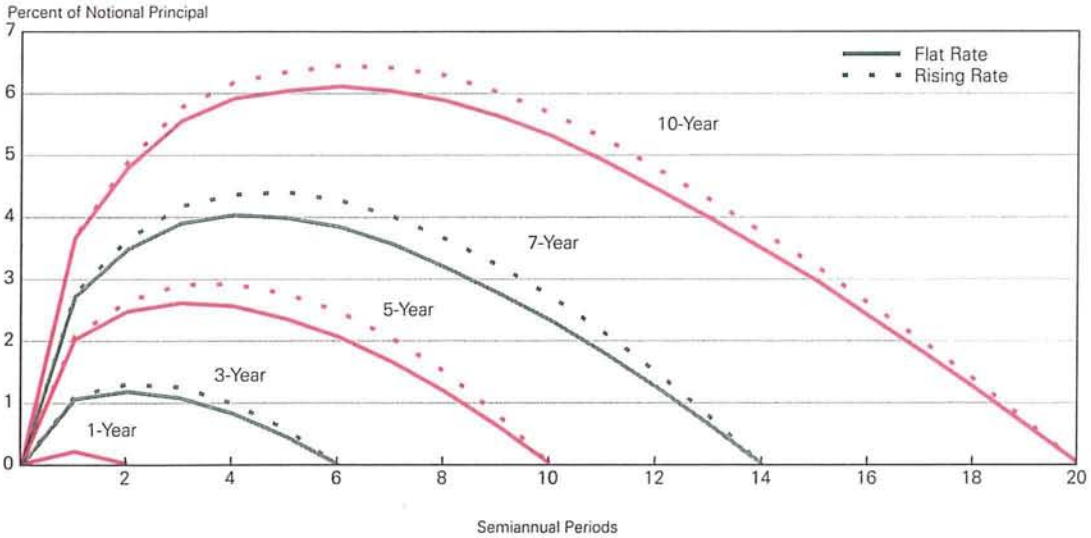
While Figure 4 shows expected credit exposures for swaps *in each semiannual period*, Table 5 reports confidence intervals for average *lifetime* exposure for swaps of each maturity. These estimates are, perhaps, the most relevant measures of the total lifetime credit risk, since they show the confidence intervals for the semiannual exposures averaged throughout the swap's lifetime. These numbers have the following interpretation: 11.22 percent exposure at the 99th confidence interval for the 10-year swap with the "flat" interest rate path means that in only 1 percent of the simulations did the lifetime exposure exceed 11.22 percent of notional principal.[4] Similarly, under the conditions of a "rising" interest-rate path, the exposure exceeded 13.07 percent of the swap notional principal 1 percent of the time. Therefore, given the initial level of interest rates and the interest rate forecast implied by the yield curve, one might assign a potential credit exposure of 13 percent to the 10-year swap. Admittedly, the 99 percent confidence interval implies an extremely cautious measure of lifetime credit exposure, and less cautious estimates may be appropriate. The least cautious measure of lifetime exposure offered by these simulations is the mean expected lifetime exposure, shown in the last row of Table 4. This is simply the average of expected exposures in each semiannual settlement period.

The comparison of average lifetime exposures reveals the same pattern as the semiannual exposures. In particular, swaps of higher maturity reach higher lifetime credit exposures, and a rising interest rate pattern results in higher exposure than a random walk without a trend.

[4] Although the analysis was performed in terms of matched pairs of swaps, the percentages of notional principal shown here should be understood to apply to one swap out of the two in a matched pair, because only one swap out of the pair can present credit risk at any one time.

Figure 4

Discounted Expected Credit Exposures



V. Conclusion

This article has described the use of Monte Carlo simulations to estimate potential credit exposures of simple interest rate swaps. It also has demonstrated a simple way to incorporate an interest rate forecast that is implicit in the yield curve into the simulations. The usefulness of this approach is predicated on the validity of the assumptions imbedded in the model, namely the relevance for the future of the past interest rate volatilities, the appropriateness of the lognormal distribution itself, and the degree to which one wishes to rely on the implicit interest rate forecast from the yield curve.

It must also be emphasized that for a swap to result in a loss, two events must occur: the swap must be costly to replace, and the counterparty must default. These simulations are relevant only for estimating potential exposure, or replacement cost, and have nothing to say about the probability of counterparty default. While it is possible to do a separate credit analysis of the counterparty and treat the replacement cost and the probability of default as two separate problems, they may not, in fact, be independent events for many swap users. In particular, the financial health of many users is directly affected by changes in the absolute level of interest rates, as well as the shape of the yield curve. The asset and liability structure of many banks and thrifts, for instance, is such that they are more profitable at times when interest rates are low and the yield curve is steep. They are, thus, unlikely to default under such circumstances even if their swaps have high replacement costs for their counterparties. At the same time, since weaker counterparties tend to pay fixed and receive floating in swap transactions, they are unlikely to default on their swap contracts when interest rates move higher.

These factors may partially account for the favorable default history swaps have enjoyed so far.[5] The swap market also has developed various modifications to the "plain vanilla" swap contract over the past few years, at least some of which minimize the credit risk of swaps. One such modification consists of marking the swap to market at periodic intervals and requiring the counterparty whose side has a negative market value to make a cash payment to the counterparty whose side has a positive value, after which the interest rate is reset at the current rate. Another variation consists of limiting the maximum

[5] A recent survey by the ISDA and Arthur Andersen & Co. estimated that actual default losses on swaps amount to 0.02 percent of the outstanding notional principal. See ISDA (1992).

size of potential swap payments by combining swaps with interest rate caps, floors, and collars. By buying a cap, for example, a floating-rate payer will never have to pay more than a certain percentage above the initial floating rate. While this would reduce credit risk, it would also expose the seller of the cap to interest rate risk or, alternatively, make it necessary for the seller to buy a hedge for the cap, thus increasing costs. Such variations of swap contracts, while valuable in reducing credit risk, incur higher administrative costs, and they still account for a small proportion of the market vis-à-vis plain vanilla swaps.

Bank regulators have recognized the credit risk of swaps and instituted capital requirements for them and for other off-balance-sheet activities, as part of the new risk-based capital requirements for banks. These requirements were developed as part of the international Basle Accord, which standardizes capital requirements among the commercial banks of the 12 industrialized nations. The new requirements call for banks to hold capital equal, at a minimum, to 8 percent of "risk-adjusted assets." Swaps are included in the calculation of the risk-adjusted assets by being converted to "credit-risk equivalents," or estimates of credit risk that make them comparable to loans and other on-balance-sheet items. For interest rate swaps, the credit-risk equivalent is equal to one-half of the sum of 1) the replacement cost of the swap and 2) 0.5 percent of the notional principal if the swap's maturity is greater than one year. Capital must be held against the credit-risk equivalent, just as it would be against loans and other assets.

A number of large swap dealers have addressed their counterparties' concern over credit risk by setting up separately capitalized "special purpose vehicles" (SPVs) that are capitalized highly enough to merit the highest rating from credit-rating agencies. Despite such efforts, however, the phenomenal growth of the swap market in the past decade assures that swap credit exposure will remain a concern both for intermediaries and final users. It is important to keep in mind, however, that swaps confine credit exposure to net differences in cash flows and do not involve the underlying notional principal. To the extent that swaps replace on-balance-sheet obligations of counterparties, they reduce rather than increase the credit risk in the financial system.

Appendix

As a general rule, the relationship between a long-term rate prevailing at any time and the sequence of expected short-term rates expected to prevail in the future can be expressed by the following formula:

$$(1 + r_0^N) = \prod_{i=1}^{N} (1 + r_i^0)^{1/N} \tag{A1}$$

where r_0^N is the long-term rate of return on a security of term N and r_i^0 is the short-term rate of return prevailing in each subsequent period i.

Specifically, if according to the swap yield curve in Figure 2, the current 1-year rate is 3.688 percent, and the current 6-month rate is 3.563 percent, then the 6-month rate six months from now is:

$$((1 + 0.03688)^2/(1 + 0.03563) - 1) \times 100 = 3.8127 \text{ percent.}$$

Similarly, if the current 1.5-year rate is 3.979 percent, and the first two successive 6-month rates are as above, then the expected 6-month rate a year from now is:

$$((1 + 0.03979)^3/(1 + 0.035625)(1 + 0.038127) - 1) \times 100 = 4.5637 \text{ percent.}$$

This process can be iterated until each successive expected 6-month rate is derived from the relevant long-term rate and all the previously derived expected 6-month rates. The results of these calculations are shown in Table 4.

References

Board of Governors of the Federal Reserve System. "Capital Adequacy Guidelines." Washington, D.C.: Board of Governors of the Federal Reserve System.

Board of Governors of the Federal Reserve System and Bank of England. 1987. "Potential Credit Exposure on Interest Rate and Foreign Exchange Rate Related Instruments." Unpublished technical working paper.

International Swap Dealers Association. 1987. Comment letter from Patrick de Saint-Aignan, Chairman, to Brian Quinn, Head of Banking Supervision, Bank of England, and William Wiles, Secretary, Board of Governors of the Federal Reserve System, May 28.

———. 1992. "Analysis of the Results of the ISDA Default Survey." Released with Arthur Andersen & Co. "ISDA Default Survey" and a news release by Dewe Rogerson, Inc., New York, N.Y., July 29, 1992.

Laderman, Elizabeth. 1993. "Risks in the Swaps Market." Federal Reserve Bank of San Francisco, *FRBSF Weekly Letter*, no. 93–10, March 12.

Mishkin, Frederic S. 1990. "Yield Curve." National Bureau of Economic Research, Inc. *Working Papers Series*, Working Paper no. 3550.

Simons, Katerina. 1989. "Measuring Credit Risk in Interest Rate Swaps." *New England Economic Review*, November/December, pp. 29–38.

Wishon, Keith and Lorin Chevalier. 1985. "Interest Rate Swaps—Your Rate or Mine?" *Journal of Accountancy*, vol. 63, September, pp. 63–64.

How Dependent Are New England's Mid-Sized Firms on the Region's Largest Bank Holding Companies?

Robert Tannenwald

Economist, Federal Reserve Bank of Boston. The author's acknowledgments appear at the end of the article.

The availability of credit to mid-sized firms—the "middle market"—has been a topic of concern and debate in recent years. It is widely believed that mid-sized firms obtain most of their financial services from a single commercial bank, usually a large bank headquartered within their region. In this traditional view, the firms tend to develop a long, close relationship with their chosen bank, depending on it heavily for a wide array of financial services, especially short-term credit.

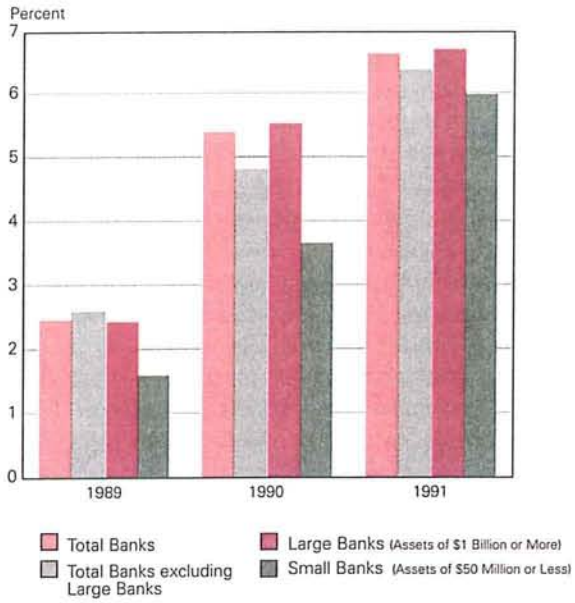
If this scenario is correct, this dependence has two important implications for public policy. First, New England's mid-sized firms, companies with revenues ranging from $10 million to $249 million, could suffer from the concentration that exists in the region's banking markets. At the time of this study, New England had only 14 bank holding companies with deposits of $1 billion or more. In 1992, three institutions controlled almost 65 percent of the deposits of this "group of 14" and granted almost 80 percent of its commercial and industrial loans. Given such high degrees of concentration, these three institutions could in theory raise prices for mid-sized business customers above the level of a more competitive market.

The second implication of this assumed dependence is that mid-sized businesses in New England may have had trouble obtaining adequate credit at any price during the past three years. Recent studies have shown that the difficulties plaguing the region's banks during this period reduced the supply of credit within the region. Short on capital and fearful of regulators, the region's banks curtailed lending. The resulting "credit crunch" is thought to have accentuated the region's economic contraction and retarded its recovery (Peek and Rosengren 1992).

This credit crunch may have hurt mid-sized businesses the most, if indeed they depend primarily on the region's large banks. Overall, New England's large banks had a higher incidence of problem loans during the 1989 to 1992 recession than did the other banks in the region

Figure 1

Nonperforming Loans as a Percentage of Total Assets of First District Commercial Banks, 1989 to 1991



Source: Federal Deposit Insurance Corporation, Condition of Income Report, 1989 to 1991.

(Figure 1). Bank of New England, the second largest bank holding company in the region in 1989, failed in 1990. Faced with reduced lending by their traditional credit sources, large firms could turn to financial institutions based outside the region or issue their own commercial paper. Small firms tend to rely more on small banks, which are more numerous and on the whole performed better than their larger counterparts.

The premise that mid-sized firms depend heavily on large banks headquartered within their region has not been adequately investigated. To help rectify this and to clarify the situation for policymakers, the Research Department of the Federal Reserve Bank of Boston conducted a survey investigating where New England's mid-sized firms obtain their short-term credit. The survey, conducted during the summer of 1992, covered more than 1,000 businesses in the region. This article is the first in a series analyzing the survey's results. Section I describes the extent to which federal bank regulators have taken the concentration of middle lending markets into account when considering bank mergers and enforcing antitrust laws. Section II discusses the view of middle-market firms that stresses their reliance on large commercial banks in their region for short-term credit, and the problems caused by concentration in such a market. Section III describes the Boston Fed survey that tested firms' dependence on New England's banks in general and on its largest banks. Section IV analyzes the survey results, and Section V summarizes the public policy implications of these findings.

Overall, the survey found that the region's mid-sized firms are not heavily dependent on its largest commercial bank holding companies for short-term credit. However, almost three-quarters of survey respondents actively participating in short-term credit markets obtain at least some of their short-term credit from a New England bank, a degree of dependence suggesting that the region's mid-sized firms may be vulnerable to sharp contractions in lending by the region's banking institutions.

I. Middle Lending Markets in the Enforcement of Antitrust Laws

Despite the popular perception that middle-market firms depend on large regional banks, antitrust analysis and oversight of bank mergers have generally ignored the middle market. Traditionally, regulators have viewed the effects of bank mergers on the competitiveness of middle lending markets according to three assumptions: 1) distinct markets for lending to mid-sized businesses do not exist; 2) even where such markets might exist, their competitiveness is not problematic and not likely to be affected by bank mergers; and 3) although bank mergers might significantly affect the competitiveness of such markets, currently available data are insufficient to evaluate such an effect.

Elements of all three assumptions in the regulatory perspective are either implied or explicitly stated in the opinion of the U.S. Supreme Court in *United States v. Philadelphia National Bank* (374 U.S. 321), the landmark 1963 case delineating competitive standards in bank merger cases. The Court effectively ruled out the existence of a separate market for lending to mid-sized businesses by asserting that "the cluster of products . . . and services" provided by commercial banks constitutes a distinct, indivisible line of commerce. In establishing this so-called "cluster of services" doctrine, the Court implied that subsets of products or services provided by commercial banks, such as the provision of credit, should not

be considered separate product markets for the purpose of antitrust analysis.

The Court also implied, however, that geographic boundaries of commercial banking markets can vary by the size of the customer, even though commercial banking services should not be "unbundled." Specifically, markets for commercial banking services provided to small borrowers and depositors are local in nature, while markets for such services provided to "larger borrowers and depositors" could include "competition from outside the [local] area." The Court concentrated its analysis on the local markets in the case because of "Congress' evident concern . . . with preserving small business" and the lack of "evidence of the amount of business done in the [local] area by banks with offices outside the area."

Regulators have focused mostly on local banking markets and have generally affirmed the cluster of services doctrine.

Since the *Philadelphia National Bank* decision, the primary concern of bank regulators in antitrust cases has been the access of small business customers to banking services at competitive prices. Regulators assume that large businesses and middle-market firms have access to credit sources outside their geographic region. As a result, they have focused mostly on local banking markets, despite the reference in the Supreme Court's majority opinion to possible competition from nonlocal banks. They have also generally affirmed the cluster of services doctrine; the Board of Governors of the Federal Reserve System did so recently in analyzing the impact of the merger of BankAmerica Corporation with Security Pacific Corporation in 1992.[1]

Since 1991, however, the U.S. Department of Justice has rejected the cluster of services doctrine in three cases: the merger of Society Corporation and Ameritrust Corporation, the acquisition by Fleet/Norstar Financial Group of the banking subsidiaries of the failed Bank of New England Corporation, and the acquisition of First Interstate Bank of Hawaii by First Hawaiian, Inc.[2] In all three cases, the Department ruled that the market whose competitiveness was most affected by the proposed transaction (the "relevant product market") was commercial lending other than commercial mortgages, not commercial banking as a whole. In the First Hawaiian case, the Department also explicitly rejected the traditional focus on local banking markets, claiming that the relevant geographic market in the case was the state of Hawaii in its entirety. As a result of its unconventional characterization of the relevant market, the Department of Justice concluded that the proposed acquisition would significantly reduce competition, and forced the parties to the transaction to divest branches in order to mitigate the transaction's adverse effects.

In testimony before Congress, top antitrust officials in the Justice Department have explicitly argued that the cluster of services doctrine is no longer valid, and that the impact of bank mergers and acquisitions on the competitiveness of commercial lending markets should be taken into account (U.S. Department of Justice 1991). The status of the cluster of services doctrine has significant implications for middle-market lending in New England. If middle-market firms more than others depend heavily on a few banks in the region, then antitrust concerns might be well founded, and the cluster doctrine may be a significant hurdle in these firms' access to credit.

But the Federal Reserve's Board of Governors disagreed with the Department of Justice in all three cases mentioned above, citing the inability of the Department to muster sufficient evidence to support its challenge to the cluster of services doctrine and the primacy of local markets. The Board has stated that the cluster of services doctrine and the local nature of banking markets have been substantiated by a survey it conducted in 1989 on the borrowing habits of small and medium-sized businesses.[3] That survey used a

[1] For BankAmerica Corporation, see the *Federal Reserve Bulletin*, vol. 78, pp. 338–69 (1992). See also Sunwest Financial Services, Inc., in the *Federal Reserve Bulletin*, vol. 73, pp. 463–69 (1987), in which the Board noted that "In delineating the relevant product market in which to assess the probable competitive effects of a bank acquisition or merger, the Supreme Court has determined that 'commercial banking is the appropriate line of commerce' on the basis that the 'cluster of products . . . and services' provided by commercial banks is unique relative to other institutions."

[2] See Society Corporation in the *Federal Reserve Bulletin*, vol. 78, pp. 302–8 (1992), Fleet/Norstar Financial Group, Inc., in vol. 77, pp. 750–58 (1991), and First Hawaiian, Inc., in vol. 77, pp. 52–59 (1991).

[3] See First Hawaiian, Inc., in the *Federal Reserve Bulletin*, vol. 77, pp. 52–59 (1991). The study (Elliehausen and Wolken 1990), sponsored jointly by the Board of Governors and the U.S. Small Business Administration, was a survey of a nationally representative sample of 3,405 small (0–49 employees) and medium-sized (50–499 employees) for-profit, nonagricultural, nonfinancial enterprises. The study found that "overwhelmingly, the single most

Middle Lending Markets in New England in 1984

Constance Dunham (1986) is the only analyst to have investigated New England's middle lending markets in any empirical detail. She found that in 1984 New England had four such markets—one based in Boston and including Maine, New Hampshire, northern Vermont, and most of eastern Massachusetts; one based in Providence and including Rhode Island, a part of eastern Massachusetts, and a part of western Connecticut; one based in Hartford and including most of Connecticut, western Massachusetts, and southern Vermont; and one based in New York City and including the southeastern part of Connecticut. She determined these boundaries by matching the location of the headquarters of a large sample of New England's middle-market firms with the location of their "primary bank," as indicated in Standard & Poor's *Register*.

Dunham suggested that treatment of banking markets as either local or national, and the assumption that banks that are not locally limited have access to the national banking market, are both questionable. At the time of her study, however, the three regional markets with centers in Boston, Hartford, and Providence did not exhibit a high degree of concentration. The Hartford and Providence regions were moderately concentrated, while the Boston region appeared to be either unconcentrated or moderately concentrated.

Dunham did note that mergers and acquisitions occurring prior to her study were responsible for increases in regional deposit concentration. She argued that the identification of regional markets suggests that "there exist combinations of banking organizations that would not harm local banking competition but would have significantly adverse effects on regional competition." Lastly, Dunham stressed that the traditional method of relieving anticompetitive concentration in local markets, the selective divestiture of branches, has little effect on overconcentration in regional markets.

Whether Dunham's results are valid today is uncertain. New England's middle lending markets may have integrated since 1984, given the relaxation of constraints on interstate banking that occurred over the last decade. Moreover, the limitations on the data available to her were significant. For example, all that she could identify was a firm's "primary bank," as reported in Standard & Poor's *Register*. Credit market analysts use this term to describe the bank that supplies a mid-sized firm with most of its credit. Yet firms might interpret the term differently, perhaps as the bank that handles their checking account. These distinctions are irrelevant only if one accepts the theory that mid-sized businesses purchase their banking services in a cluster. Furthermore, firms listed in Standard & Poor's *Register* were not given the option of listing a nonbank financial institution as their "primary bank."

nationwide sample consisting mostly of small businesses, however, and the number of medium-sized New England businesses in the sample was too small to draw conclusions about the characteristics of the middle lending market in New England. For the regional perspective, the Box describes economist Constance Dunham's 1986 study of the middle markets for lending in New England.

important financial institution for nearly every product and service used by small and medium-sized businesses is a local commercial bank." Almost all firms in the sample consider a local commercial bank to be their primary institution, and tend to cluster their purchase of financial services there around the checking account; on average, respondents use 2.29 products from the financial institution that provides them with their checking account, compared to only 1.08 services from institutions supplying them with services other than checking. For a summary of the study, see the *Federal Reserve Bulletin*, vol. 76, pp. 726–27 (1990).

II. Caught in the Middle—the Dilemma of the Mid-Sized Firm

The traditional perception of middle lending markets described at the outset of this article clearly contrasts with the Federal Reserve Board's position. In the former, mid-sized firms are seen as too large to obtain credit from small banks but too small to shop for credit nationwide. In addition, they are seen as large enough to need a wide range of interrelated financial services but too small to provide them in-house or to procure them from an array of financial institutions over a broad geographic area. Both conditions would reinforce the firms' dependence on large commercial banks in their region.

Legal limits on the amount of credit that a bank can extend to any one borrower make it difficult for

mid-sized firms to borrow from small banks. Federal law prohibits national banks from extending to any one borrower unsecured credit whose value exceeds 10 percent of their "unimpaired capital."[4] Suppose that a bank's capital-to-loan ratio is 0.05. Under federal law, the bank could lend only 0.5 percent, or 0.005 (.10 × .05) of its loan portfolio to a single borrower. In order to make a $1 million loan to a single business, the bank would need a total loan portfolio of $200 million ($1 million / 0.005). In the first quarter of 1993, only 32 commercial banks in the First Federal Reserve District, 20 percent of the total number, had a loan portfolio of $200 million or more.[5]

Legal limits on the amount of credit that a bank can extend to any one borrower make it difficult for mid-sized firms to borrow from small banks.

In addition to being unable to provide loans of sufficient size, small banks are also unable to offer mid-sized firms the range of services that they need. These include financial planning, deposit services, cash management, advice on short-term investments, specialized credit services, foreign exchange, and international banking services.

In theory, mid-sized firms could obtain some of these services from a constellation of nonbank financial firms. More middle-market firms have availed themselves of nonbank sources during the past decade, as deregulation has intensified the competition between bank and nonbank financial institutions. Yet it is still easier for mid-sized firms to obtain these services in a cluster from their primary supplier of credit. Mid-sized firms, the traditional view argues, still tend to establish extensive relationships with that supplier, who often plays a major role in advising and even directing the firm.

Large banks outside New England could provide the region's middle-market businesses with the financial services and volume of credit that they need. Indeed, such banks do have many New England middle-market customers. Moreover, during the past 15 to 20 years money-center banks have become increasingly interested in lending to mid-sized firms as their larger customers, the so-called "blue chip" market, have gained access to credit markets without the help of bank intermediation.

However, the costs of transacting business over long distances can still deter large banks from catering extensively to middle-market firms located in regions where they lack a substantial presence. Large banks find evaluating the creditworthiness of distant mid-sized businesses to be especially difficult and costly. The financial condition of middle-market firms generally is not researched by credit rating agencies. The banks are not familiar with the regional and local economic environment in which the firms operate. Conversely, it is expensive for mid-sized firms to search for credit sources outside of their region. Moreover, the top management of a large, distant bank with a global clientele may not give mid-sized clients the timely, considered advice and quick feedback on loan applications that they desire.[6]

III. Description of the 1992 Survey Sample

The Boston Fed's survey was designed to measure current credit availability for middle-market firms, and also to gauge the likely impact on such firms of future reductions in credit availability. The sample of businesses interviewed for the 1992 survey was drawn from the approximately 6,000 private, for-profit firms that in 1991 were headquartered in the First District, reported gross revenues greater than or equal to $10 million and less than $250 million, and were listed in Dun & Bradstreet's 1991 *Middle Market Directory*.

The sample of interviewed firms was not randomly drawn from this population of 6,000. Rather, the population was first divided, or "stratified," into size and industry groups. A random sample was then drawn from each of these groups.[7] Groups with small populations were sampled at high rates in order to ensure representation of a broad array of industry

[4] 12 *Code of Federal Regulations*, 3.5–3.13.

[5] In addition to commercial banks, many savings banks do make some commercial and industrial loans. At the end of 1992, the First District had 70 state-chartered savings banks with loans and leases greater than $200 million.

[6] See Burnside (undated), Koch (1991), and Dunham (1986) for further elaboration of the view that middle-market lending is a distinct financial market.

[7] A letter from Boston Fed president Richard F. Syron was sent to the chief executive of each of the firms, introducing the survey and announcing that they might be contacted by phone.

Table 1
Description of Survey Sample and Interview Results, by Size and Industry

Industrial Stratification[a]	Sample Size	Target Completions	Actual Completions	Percent of Target Completed
A. Small Firms Subsample, $10 Million to $49 Million in Annual Sales				
Agriculture and Forestry Services	5	5	2	40.0
Heavy Construction Contractors	67	43	25	58.1
Builders and Special Trade	135	78	58	74.4
Printing and Publishing	97	54	53	98.1
Apparel Products	45	32	23	71.9
Leather Products	25	20	13	65.0
Retail Apparel	29	23	12	52.2
Other Mining, Construction, Manufacturing, and Durable Trade[b]	170	99	95	96.0
Transportation, Communications, and Public Utilities	120	71	64	90.1
Real Estate	115	65	35	53.8
Insurance and Securities Brokers and Agents	115	66	65	98.5
Investment Companies and Nonbank Holding Companies[c]	11	10	5	50.0
Services	165	91	91	100.0
Small Firms with Low Bank Dependency[d]	165	96	95	99.0
Totals	1,264	753	636	84.5
B. Medium-Sized Firms Subsample, $50 Million to $99 Million in Annual Sales				
Heavy Construction Contractors and Special Trade	6	6	3	50.0
Builders	10	8	6	75.0
Coal Mining and Nonmetallic Mining	1	1	1	100.0
Printing and Publishing	8	8	6	75.0
Apparel Products	2	2	1	50.0
Miscellaneous Retail	13	12	7	58.3
Leather Products	5	5	4	80.0
Retail Apparel	4	4	2	50.0
Eating and Drinking Places	4	4	3	75.0
Other Mining, Construction, Manufacturing, and Durable Trade[e]	124	71	74	104.2
Transportation, Communications, and Public Utilities	25	20	14	70.0
Real Estate	7	7	2	28.6
Insurance and Securities Brokers and Agents	22	20	12	60.0
Investment Companies and Nonbank Holding Companies	4	4	1	25.0
Services	106	61	64	104.9
Medium-Sized Firms with Low Bank Dependency[f]	90	60	59	98.3
Totals	431	293	259	88.4

[a]Industry groups differ by size subsample because, in each size subsample, an attempt was made to aggregate 2-digit industries into groups exhibiting a similar degree of dependence on banks for short-term credit. Measures of this dependence indicate that 2-digit industries exhibiting a similar degree of "bank dependence" in one size group do not necessarily indicate a similar degree of bank dependence in another size group. See the text and forthcoming working paper for further details.

[b]Includes metal mining; coal mining; mining and quarrying of nonmetallic minerals (except fuels); textile mill products; lumber and wood products (except furniture); furniture and fixtures; paper and allied products; chemicals and allied products; petroleum refining and related industries; rubber and miscellaneous plastics products; stone, clay, glass, and concrete products; primary metal industries; fabricated metal products (except machinery and transportation equipment); industrial and commercial machinery and computer equipment; electronic and other electrical equipment and components (except computer equipment); transportation equipment; measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; watches and clocks; miscellaneous manufacturing industries; wholesale trade—durable goods; building materials, hardware, garden supply, and mobile home dealers; general merchandise stores; home furniture, furnishings, and equipment stores; eating and drinking places and miscellaneous retail.

[c]Includes offices of holding companies, not elsewhere classified (SIC 6719); investment offices (SIC 672) and investors, not elsewhere classified (SIC 679).

[d]Includes food and kindred products; tobacco products, wholesale trade—nondurable goods, food stores, automotive dealers and gasoline service stations, and insurance carriers.

Table 1 *continued*

Description of Survey Sample and Interview Results, by Size and Industry

Industrial Stratification	Sample Size	Target Completions	Actual Completions	Percent of Target Completed
C. Large Firms Subsample, $100 Million to $249 Million in Annual Sales				
Builders and Special Trade	3	3	3	100.0
Heavy Construction	7	7	4	57.1
Printing and Publishing	4	4	1	25.0
Oil and Coal Products	1	1	1	100.0
Food and Tobacco Products	13	12	8	66.7
Leather Products	7	7	3	42.9
Durable Wholesale	21	19	11	57.9
Automobile Dealers	3	3	2	66.7
Other Mining, Construction, Manufacturing, and Durable Trade[g]	108	59	60	101.7
Transportation, Communications, and Public Utilities	21	19	11	57.9
Nondurable Wholesale	30	23	13	56.5
Eating and Drinking Places	2	2	2	100.0
Food Stores	3	3	3	100.0
Real Estate	5	5	3	60.0
Insurance Carriers and Insurance and Securities Brokers and Agents	20	18	10	55.6
Investment Companies and Nonbank Holding Companies	2	2	0	0.0
Services other than Amusement and Recreation	47	33	18	54.5
Totals	297	220	153	69.5
Total Sample	1,992	1,266	1,048	82.8

[e]Includes metal mining; oil and gas extraction; textile mill products; lumber and wood products (except furniture); furniture and fixtures; paper and allied products; chemicals and allied products; petroleum refining and related industries; rubber and miscellaneous plastics products; stone, clay, glass, and concrete products; primary metal industries; fabricated metal products (except machinery and transportation equipment); industrial and commercial machinery and computer equipment; electronic and other electrical equipment and components (except computer equipment); transportation equipment; measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; watches and clocks; miscellaneous manufacturing industries; wholesale trade—durable goods; building materials, hardware, garden supply, and mobile home dealers; general merchandise stores; home furniture, furnishings, and equipment stores.

[f]Includes food and kindred products; tobacco products; wholesale trade—nondurable goods, food stores, automotive dealers and gasoline service stations, and insurance carriers.

[g]Includes metal mining; mining and quarrying of nonmetallic minerals (except fuels); textile mill products; apparel and other finished products made from fabrics and similar materials; lumber and wood products (except furniture); furniture and fixtures; paper and allied products; chemical and allied products; rubber and miscellaneous plastics products; stone, clay, glass and concrete products; primary metal industries; fabricated metal products (except machinery and transportation equipment); industrial and commercial machinery and computer equipment; electronic and other electrical equipment and components (except computer equipment); transportation equipment; measuring, analyzing, and controlling instruments, photographic, medical, and optical goods, watches and clocks; miscellaneous manufacturing industries; building materials, hardware, garden supply, and mobile home dealers; general merchandise stores; apparel and accessory stores; miscellaneous retail.

and size groups and thereby permit an analysis of how short-term borrowing characteristics of middle-market firms vary by size and industry.

It is reasonable to hypothesize that such variation exists. For example, smaller middle-market businesses may tend to exhibit some small-firm borrowing traits, such as dependence on local banks. Conversely, firms at the high end may tend to exhibit some large-firm traits, such as issuance of commercial paper and borrowing from large banks headquartered outside of New England. Within a given size group, other things equal, one would expect firms in industries with high ratios of notes and accounts receivable to sales, inventories to sales, and depreciable assets to sales to have a relatively strong need for a reliable source of short-term credit. As a result, these firms might have a greater need to establish a primary banking relationship.

The population was arbitrarily divided into three size groups, based on annual sales: $10 million to $49 million, $50 million to $99 million, and $100 million to $249 million. Over 80 percent of the population fell into the small size category, while less than 8 percent fell into the large one.

Stratification by industry proved more troublesome. Given the limited resources available for the survey, too detailed a stratification would have resulted in inadequate sample sizes for many industry/size groups. On the other hand, if the stratification by industry had been too coarse, significant intra-industry variation in borrowing characteristics would have been overlooked. To give an example, 62 percent of all retail establishments in the $10 million to $49 million range were either automobile dealerships or service stations. Auto dealerships and service stations often enjoy atypical financial arrangements with automobile manufacturers and gasoline companies, respectively. Any conclusions drawn about the retail sector as a whole would clearly have been biased unless auto dealers and service stations were broken out and sampled separately.

The following compromise strategy was adopted. Firms in each size group were classified into industries defined by the U.S. Office of Management and Budget's 2-digit Standard Industrial Classification (SIC) Code. Each size/industry group was evaluated in terms of its hypothesized dependence on banks for short-term credit. Criteria for identifying groups with low likely "bank dependence" were low ratios of 1) notes and accounts receivable to sales, 2) inventories to sales, and 3) depreciable assets to sales. (Examples of industries exhibiting low bank dependence throughout the middle market range were producers of food products, wholesale traders of nondurable goods, and insurance carriers.) Within each size group, industries exhibiting a similar degree of hypothesized bank dependence were lumped together, creating in total 47 industry/size groups for stratification purposes (Table 1).

Each industry/size group was sampled at a different rate, determined in a way that would maximize the chance, given the estimated total number of telephone calls possible, that each group would be adequately represented in the sample of firms ultimately interviewed. The minimum sample considered to be adequate depended on the size of the group in the target population, the minimum acceptable margin of error in the survey, hypothesized response rates, and probability theory. Data on sample sizes and survey completions are also found in Table 1.[8]

[8] Further details of the considerations governing the sampling strategy, along with a copy of the survey instrument, will be provided in a working paper, available from the author.

IV. Survey Results

The survey probed the characteristics of New England's middle lending markets by asking each respondent to group its sources of short-term credit into four categories: banks, nonbank financial institutions, its parent company (if the respondent was not an independent firm), and the issuance of commercial paper. The respondent was asked the name and location of each bank and nonbank institution from which it currently obtains short-term credit, and the reasons for selecting each institution as a credit source. If the respondent had no short-term credit arrangements, it was asked whether it lacked such arrangements because it did not need them or because they had recently been terminated. This question was designed explicitly to investigate the extent of the region's credit crunch.

Because the survey included questions about the location of lenders, its results will eventually provide insights into the geographic boundaries of New England's middle lending markets. In order to share as many of the survey's results as soon as possible, however, this article assumes that the region's mid-sized businesses generally obtain their short-term credit in one region-wide market.

Evidence Concerning the Dependence of Mid-Sized Firms on New England's Largest Commercial Banking Organizations

The results of the survey suggest that the region's largest commercial banking organizations would have difficulty raising prices affecting mid-sized firms above competitive levels. As Table 2 indicates, only 23 percent of all respondents indicated that they depend solely on one of the region's three largest commercial banking organizations for short-term credit. Only 33 percent reported obtaining any of their short-term credit from one of these organizations. These percentages did not vary significantly by size group, and fall below the level of concentration that the Board of Governors uses as a benchmark for potential problems, beyond which they retain authority to rule on bank merger applications.[9]

[9] When the Federal Reserve System processes a bank merger application, it first decides whether the case is likely to pose problems. If so, the Board of Governors must decide the case. If not, the Board delegates the authority to decide the case to the appropriate regional Federal Reserve Bank. Several measures are used to determine whether the Board must retain this authority. One of them is the impact of the proposed merger on the

Table 2
Sources of Short-Term Credit by Size Group, All Survey Participants
Percent of Respondents in Size Group

Source of Short-Term Credit	Large Firms ($100 Million to $249 Million)[a] (1)	Medium-Sized Firms ($50 Million to $99 Million)[a] (2)	Small Firms ($10 Million to $49 Million)[a] (3)	All Firms (4)
1. Some or all from New England-based banks	49.4	54.5	57.5	55.6
2. All from New England-based banks	39.3	41.5	50.8	47.0
3. Some or all from one or more subsidiaries of the three largest bank holding companies in New England[b]	38.7	37.5	29.4	32.6
4. All from one or more subsidiaries of the three largest bank holding companies in New England[b]	19.0	24.6	22.9	22.6
5. Some or all from domestic banks based outside of New England	11.9	8.0	6.2	7.5
6. Some or all from parent company	15.5	8.5	5.9	8.0
7. Some or all from nonbank source other than parent company	3.0	14.7	9.9	9.8
8. No short-term credit because credit arrangements terminated within past two years	1.2	3.6	4.4	3.7
9. No short-term credit and no need for it	16.7	16.5	17.9	17.4

[a]1991 annual sales.
[b]As of June 30, 1992, the three largest New England banking organizations, by deposits, are:
1. Fleet Financial Group, Providence, Rhode Island
2. Bank of Boston Corporation, Boston, Massachusetts
3. Shawmut National Corporation, Hartford, Connecticut

Table 2 is misleading, however, because some respondents do not participate in New England's short-term credit markets. More than 17 percent stated that they do not need short-term credit. (Again, virtually no significant variation in this percentage occurs across size groups.) Another 8 percent (16 percent of respondents in the $100 million to $249 million range) indicated that they are subsidiaries and their parent company provides them with some or all of their short-term credit. Since neither of these two groups of businesses has a demand for short-term credit, they are, in effect, "dormant" players in the region's short-term credit markets. As such, analyses of these markets' characteristics should exclude these businesses from the sample.

concentration of deposits in local banking markets where the parties to the proposed merger have branches. The impact on concentration is measured by the percentage of deposits in each market that the parties would control upon consummation of the merger. The Board of Governors must retain authority to rule on the application if any of these percentages exceed 35 percent. Given that only 33 percent of the surveyed firms obtained credit from the three largest commercial banking organizations, the Board's standard suggests that competitiveness of middle-market lending in New England is sufficient to alleviate antitrust concerns.

Even when these two groups are excluded, however, the remaining subsample shows no evidence of excessive market concentration. Fewer than 30 percent of the firms in the subsample obtain all of their short-term credit from one or more subsidiaries of one of the region's three largest bank holding companies (Table 3, line 4, column 4). Among the three size groups, the $50 million to $99 million group showed the highest degree of dependence on the "big three." Yet less than 32 percent of the firms in this size group rely solely on these institutions for their short-term credit (line 4, column 2).

Evidence of Vulnerability to Regional Credit Crunches

The respondents' overall lack of dependence on the region's large commercial banking organizations casts doubt on the hypothesis advanced earlier that the credit crunch harmed the region's mid-sized firms more than their smaller or larger counterparts. (As stated in the introduction, this hypothesis rested on the poor performance of the region's large banking organizations relative to its banking industry as a whole.)

Table 3
Sources of Short-Term Credit by Size Group, Subsample of Survey Participants[a]
Percent of Respondents in Size Group

Source of Short-Term Credit	Large Firms ($100 Million to $249 Million)[b] (1)	Medium-Sized Firms ($50 Million to $99 Million)[b] (2)	Small Firms ($10 Million to $49 Million)[b] (3)	All Firms (4)
1. Some or all from New England-based banks	70.3	70.1	74.8	73.1
2. All from New England-based banks	55.0	52.8	65.6	61.2
3. Some or all from one or more subsidiaries of the three largest bank holding companies in New England[c]	55.1	48.3	38.3	42.9
4. All from one or more subsidiaries of the three largest bank holding companies in New England[c]	26.9	31.6	29.7	29.7
5. Some or all from domestic banks based outside of New England	16.9	10.3	8.1	9.9
6. Some from parent company	3.4	3.4	1.0	1.9
7. Some or all from nonbank source other than parent company	4.2	19.0	12.8	12.9
8. No short-term credit because credit arrangements terminated within past two years	1.7	4.6	5.7	4.9

[a]Excludes firms not needing credit and firms obtaining credit solely from their parent company.
[b]1991 annual sales.
[c]As of June 30, 1992, the three largest New England banking organizations, by deposits, include:
1. Fleet Financial Group, Providence, Rhode Island
2. Bank of Boston Corporation, Boston, Massachusetts
3. Shawmut National Corporation, Hartford, Connecticut

Yet the survey was conducted too late in the regional business cycle to estimate the full extent of this hardship. The region's credit availability problems were probably at their worst during the last half of 1990 and the first half of 1991, several quarters after the performance of the region's banking industry hit its low point. By mid 1992, when this survey was administered, middle-market firms most affected by the scarcity of short-term credit may already have been pushed out of business. Consequently, to the extent that mid-sized businesses were forced to close their doors after losing their sources of short-term credit, a portion of them are probably not in the survey sample.

The survey instrument included one question explicitly investigating the credit crunch's impact. If a respondent reported having no short-term credit arrangement, the respondent was asked whether the firm's supplier (or suppliers) of credit had terminated such arrangements within the previous two years. About 4 percent of all respondents reported such an involuntary loss of credit (Table 2). Several other respondents with short-term credit arrangements volunteered that they had lost their credit lines in recent years but had managed to find alternate sources.

The survey was also designed to gauge the likely impact of future credit crunches on New England's middle market. Vulnerability to future constrictions in the availability of credit depends on the degree of reliance on the region's banks. Only 47 percent of all respondents obtained their short-term credit solely from a New England-based bank; only 56 percent obtained any of their short-term credit from such a bank (Table 2).[10]

[10] The survey did not include questions probing differences in the price of credit by source. Credit from sources other than New England-based banks may be relatively expensive in part because the amount of credit supplied by the region's banks may be limited. If so, the survey's results may understate the impact of future credit crunches on the region's mid-sized firms. On the other hand, firms relying solely on New England-based banks may have access to other sources of credit but have chosen not to utilize them. If so, the survey's results may exaggerate the vulnerability of the region's mid-sized businesses to future credit crunches.

The survey shows that the region's mid-sized firms were able to obtain short-term credit from sources other than New England-based banks *at some terms*, no matter how expensive. This finding, in and of itself, has surprised many observers of New England's commercial banking markets.

As noted earlier, however, several of the respondents have no need for an independent source of short-term credit because they do not need such credit or obtain it from the parent company of a multicorporate entity with which they are affiliated. When these two "dormant" groups are eliminated from the sample, the percentage of the remaining subsample totally dependent on New England-based banks for short-term credit rises to 61 percent; the percentage obtaining any short-term credit from such banks rises to 73 percent (Table 3).[11]

Very little variation was found across size groups in the percentage of respondents obtaining any of their short-term credit from a bank based in New England. By contrast, the variation in sole reliance on New England banks was significant. Large and medium-sized respondents exhibited a significantly lower propensity toward complete reliance than small respondents. The large and medium-sized respondents are more likely to need a consortium of banks that includes a non-New England bank or a nonbank institution. Some of the large firms supplement their bank credit by issuing their own commercial paper.

What are the policy implications of the percentages presented in line 2 of Table 3, the percentage of firms that depend on banks based in New England for all their credit? What do they imply about the ramifications for New England's economy of future restrictions on the availability of bank credit within the region? This question is difficult to answer given the absence of quantitative standards defining "excessive" dependence on regional banks. On the one hand, the survey indicates that almost 40 percent of the region's middle-market firms needing independent sources of short-term credit obtain at least some of it from a source other than a New England-based bank. On the other hand, the survey indicates that almost three-quarters of middle-market firms actively participating in short-term credit markets get at least some of their short-term credit from such a bank. This latter fraction suggests that future constraints on the supply of credit could harm a significant number of borrowers in the region's middle market.

The survey probed the characteristics of New England's middle lending markets, asking each respondent to describe its sources of short-term credit.

Detail by Industry/Size Group

As alluded to in Section III, the dependence of New England's mid-sized businesses on the region's large commercial banks may vary by industry as well as size group within the middle-market range. If so, regulators analyzing the antitrust implications of bank mergers may need to evaluate the concentration of particular segments of middle lending markets as well as the markets as a whole. Similarly, significant variation by industry/size group may exist. If so, mid-sized New England businesses in heavily bank-dependent industry and size groups may be especially vulnerable to regional credit crunches.

Differences across industry/size groups in respondents' sources of short-term credit are analyzed in Tables 4 through 6. Results are presented only for several of the largest industry groups. Results for large industry/size groups that exhibited a poor rate of response to the survey (a large percentage refused to be interviewed or could not be reached) are not reported.

With one exception, none of the industry/size groups exhibited a degree of dependence on the region's largest commercial banking organizations that was dramatically higher than that exhibited by

[11] Firms indicating no need for short-term credit in fact may want it but have decided to forgo it because they have been unsuccessful in obtaining it or think that they cannot obtain it. Similar perceptions may have led some subsidiaries of multicorporate entities to rely on their parent company for credit. Spontaneous comments made by respondents suggest that this is not the case. Moreover, even if such perceptions did influence the credit arrangements of these firms, they have been able to adjust their arrangements without borrowing from New England-based banks. Thus, the survey indicates yet two more alternative financial arrangements available and utilized by some mid-sized firms.

Nevertheless, suppose that a perceived absence of credit sources was the reason why some firms either "go it alone" or borrow from a parent company. The percentage of all respondents 1) obtaining some or all of their credit from New England-based banks, or 2) indicating that they do not need credit, or 3) obtaining some or all of their credit from their parent company, is 81 percent (Table 2, column 4, line 1 + line 9 + line 6). Consequently, if one assumes that the "dormant" players were influenced by a perceived shortage of credit, the survey's results point to a similar conclusion when one assumes the opposite: New England's mid-sized businesses may be vulnerable to future constrictions in credit offered by the region's banks.

Table 4
Sources of Short-Term Credit, Industry Detail, Small Firms[a]
Percent of Respondents in Group

Source of Short-Term Credit	Other Manufacturing, Mining, Construction, and Durable Trade	Low Bank Dependency	Printing and Publishing	Insurance and Securities	Services Other than Personal	Transportation
A. All Respondents in Group of Small Firms						
All from New England-based banks	47.2	47.6	54.0	43.9	53.9	47.0
All from one or more subsidiaries of the three largest bank holding companies in New England[b]	24.0	19.4	22.0	17.5	26.5	28.8
Some or all from domestic banks based outside of New England	9.6	4.9	4.0	7.0	3.9	7.6
Some or all from parent company	4.0	7.8	14.0	3.5	8.8	6.1
Some or all from nonbank source other than parent company	12.8	27.2	6.0	8.8	8.8	7.6
No short-term credit because credit arrangements terminated within past two years	5.6	1.0	2.0	1.8	5.9	4.5
No short-term credit and no need for it	16.8	15.5	18.0	31.6	18.6	27.3
B. Respondents in Group of Small Firms, excluding Firms Not Needing Credit and Firms Obtaining Credit Solely from Their Parent Company						
All from New England-based banks	56.7	56.3	65.9	64.1	66.3	64.6
All from one or more subsidiaries of the three largest bank holding companies in New England[b]	28.8	23.0	26.8	25.6	32.5	39.6
Some or all from domestic banks based outside of New England	11.5	5.7	4.9	10.3	4.8	10.4
Some or all from parent company	1.0	3.4	2.4	2.6	1.2	0.0
Some or all from nonbank source other than parent company	15.4	32.2	7.3	12.8	10.8	10.4
No short-term credit because credit arrangements terminated within past two years	6.7	1.1	2.4	2.6	7.2	6.3
No short-term credit and no need for it	0.0	0.0	0.0	0.0	0.0	0.0

[a]1991 annual sales of $10 million to $49 million.
[b]As of June 30, 1992, the three largest New England banking organizations, by deposits:
1. Fleet Financial Group, Providence, Rhode Island.
2. Bank of Boston Corporation, Boston, Massachusetts.
3. Shawmut National Corporation, Hartford, Connecticut.

the survey sample as a whole or its size category as a whole. The one exception was medium-sized middle-market firms in the "services other than personal" industrial category, where 52 percent obtained short-term credit solely from a New England-based bank (Table 5), compared to 42 percent of all medium-sized respondents (Table 2). When firms not needing an independent source of short-term credit are removed, these percentages increase to 72 percent (Table 5) and 53 percent (Table 3), respectively. Firms in this industry/size group are also significantly more dependent on the region's "big three" than are all medium-sized firms.

In New England, hospitals and other health providers account for a large fraction of the middle-market firms in the "services other than personal" category. Perhaps the relatively heavy dependence of these firms on banks based within the region stems from the tendency of bank executives to serve on boards of directors of hospitals as part of their civic responsibilities. These firms' dependence might also reflect their persistent need for a stable source of

Table 5
Sources of Short-Term Credit, Industry Detail, Medium-Sized Firms[a]
Percent of Respondents in Group

Source of Short-Term Credit	Other Manufacturing, Mining, Construction, and Durable Trade	Low Bank Dependence	Services Other than Personal
A. All Respondents in Group of Medium-Sized Firms			
All from New England-based banks	36.8	38.0	52.0
All from one or more subsidiaries of the three largest bank holding companies in New England[b]	26.3	28.0	28.0
Some or all from domestic banks based outside of New England	22.8	4.0	8.0
Some or all from parent company	8.8	8.0	6.0
Some or all from nonbank source other than parent company	21.1	34.0	4.0
No short-term credit because credit arrangements terminated within past two years	1.8	4.0	4.0
No short-term credit and no need for it	7.0	14.0	28.0
B. Respondents in Group of Medium-Sized Firms, excluding Firms Not Needing Credit and Firms Obtaining Credit Solely from Their Parent Company			
All from New England-based banks	41.2	44.2	72.2
All from one or more subsidiaries of the three largest bank holding companies in New England[b]	29.4	32.6	38.9
Some or all from domestic banks based outside of New England	25.5	4.7	11.1
Some or all from parent company	7.8	2.3	0.0
Some or all from nonbank source other than parent company	23.5	39.5	5.6
No short-term credit because credit arrangements terminated within past two years	2.0	4.7	5.6
No short-term credit and no need for it	0.0	0.0	0.0

[a]1991 annual sales of $50 million to $99 million.
[b]As of June 30, 1992, the three largest New England banking organizations, by deposits:
1. Fleet Financial Group, Providence, Rhode Island.
2. Bank of Boston Corporation, Boston, Massachusetts.
3. Shawmut National Corporation, Hartford, Connecticut.

short-term credit due to long delays in obtaining reimbursements from health insurers.

V. Conclusion

The Boston Fed's survey of middle-market firms in New England attempted to measure their dependence both on the region's largest banks and on its banks in general. The survey found that mid-sized firms searching for short-term credit are by no means hostage to the pricing policies of the region's largest bank holding companies. This casts doubt on the theory that the region's credit crunch hurt mid-sized firms more than others, because of their presumed dependence on the large New England banks most affected by the recent banking cycle.

The survey also tested for reliance on the region's banks in general. Total dependence on New England banks exceeds 60 percent of surveyed firms active in short-term credit markets, and was highest for smaller firms. Partial reliance on the region's banks approaches 75 percent. These figures suggest that steep reductions in the availability of credit from the region's banks could have adverse consequences for New England's mid-sized businesses.

Table 6
Sources of Short-term Credit, Industry Detail, Large Firms[a]
Percent of Respondents in Group

	Other Manufacturing, Mining, Construction, and Durable Trade	
Source of Short-Term Credit	(A) All Respondents in Group of Large Firms	(B) Respondents in Group of Large Firms, excluding Firms Not Needing Credit and Firms Obtaining Credit Solely from Their Parent Company
All from New England-based banks	27.9	31.5
All from one or more subsidiaries of the three largest bank holding companies in New England[b]	16.4	18.5
Some or all from domestic banks based outside of New England	21.3	24.1
Some or all from parent company	24.6	5.6
Some or all from nonbank source other than parent company	8.2	9.3
No short-term credit because credit arrangements terminated within past two years	.0	.0
No short-term credit and no need for it	9.8	.0

[a]1991 annual sales of $100 million to $249 million.
[b]As of June 30, 1992, the three largest New England banking organizations, by deposits:
1. Fleet Financial Group, Providence, Rhode Island.
2. Bank of Boston Corporation, Boston, Massachusetts.
3. Shawmut National Corporation, Hartford, Connecticut.

The author wishes to thank Lesley Eydenberg, Janet Feldstein, Virginia Genao, Alain Macher, Paul Marcotte, Robert Oh, Alissa Park, Megan Sansons, Garrett Solomon, Eric Wellman, and Paul White for helping to implement the survey on which the article is based. Thanks also to Paul Charrette, Paul Marcotte, Steven McCarthy, and Megan Sansons for assisting in the analysis of the data; to James McEneaney and Betsy Morgan for helping to coordinate the implementation of the survey; to Joel Werkema for many helpful editorial suggestions; to numerous other colleagues at the Boston Fed; and to Jonathan Wolken of the staff of the Board of Governors for helpful advice on survey design.

References

Board of Governors of the Federal Reserve System. *Federal Reserve Bulletin*, various years.

Burnside, William H.L. Undated. "The Lure of the Middle Market." *Perspectives*, Financial Services Series V. Boston Consulting Group, Boston, MA.

Dunham, Constance R. 1986. "Regional Banking Competition." *New England Economic Review*, July/August, pp. 3–19.

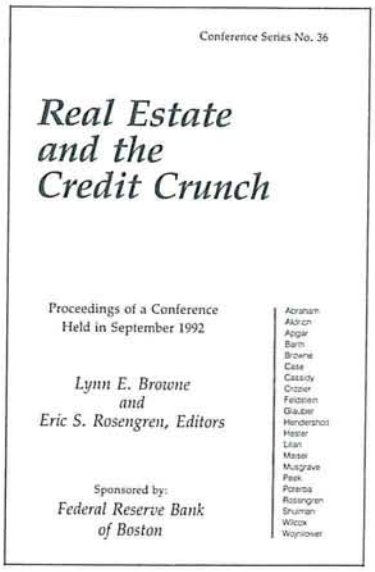
Elliehausen, Gregory E. and John D. Wolken. 1990. "Banking Markets and the Use of Financial Services by Small and Medium-Sized Businesses." *Federal Reserve Bulletin*, vol. 76, pp. 801–17.

Koch, John T. 1991. "Middle Market Strategies." *The Bankers Magazine*, November/December, pp. 33–36.

Peek, Joe and Eric S. Rosengren. 1992. "The Capital Crunch in New England." *New England Economic Review*, May/June, pp. 21–31.

U.S. Department of Justice. 1991. *Statement of James F. Rill, Assistant Attorney General, Antitrust Division, before the Committee on Banking, Finance, and Urban Affairs, U.S. House of Representatives, Concerning the Role of the Department of Justice in Analyzing Bank Mergers Under the Antitrust Laws*. September 24 (Photocopy).

Conference Series


Conference Series No. 36

Real Estate and the Credit Crunch

Proceedings of a Conference Held in September 1992

Lynn E. Browne and Eric S. Rosengren, Editors

Sponsored by: *Federal Reserve Bank of Boston*

Abraham
Aldrich
Aggar
Barth
Browne
Case
Cassidy
Crozier
Feldstein
Glauber
Hendershott
Hester
Litan
Maisel
Musgrave
Peek
Poterba
Rosengren
Shuman
Wilcox
Wojnilower

Real Estate and the Credit Crunch, proceedings of a conference sponsored by the Federal Reserve Bank of Boston, is now available. The Bank's fall 1992 economic conference explored the causes of the real estate problems of the 1980s and their implications for financial institutions and public policy. Conference participants agreed that real estate fundamentals alone cannot explain the extreme fluctuations in real estate that occurred in some regions. Among the factors thought to have contributed are a relaxation in bank lending standards, federal tax policy and financial institution regulation, and the possible role of speculative bubbles and overshooting in the real estate markets.

The proceedings include all the conference papers and discussions; the volume begins with an overview of the conference, prepared by the editors. Among the authors and discussants are Martin Feldstein, Patric Hendershott, Robert Litan, Sherman Maisel, Richard Musgrave, and Albert Wojnilower.

Copies of conference volume no. 36, *Real Estate and the Credit Crunch,* may be obtained without charge upon request to the Research Library—D, Federal Reserve Bank of Boston, P.O. Box 2076, Boston, Massachusetts 02106–2076.

Please type or print

Name _____ Title _____

Organization _____

Address _____

_____

Please check

☐ Please send Conference Series No. 36 *Real Estate and the Credit Crunch.*

☐ Please send back-issue Conference Series No. _____

Note: Single volumes will be mailed without charge, but a $10.00 payment (check drawn on a branch of a U.S. bank) will be required for more than 10 volumes or more than 10 copies of the same volume.

PLACE
STAMP
HERE

Research Library—D
Federal Reserve Bank of Boston
P.O. Box 2076
Boston, Massachusetts 02106-2076

Conference Series

The Federal Reserve Bank of Boston Conference Series

No. 1	Controlling Monetary Aggregates	June 1969
No. 2	The International Adjustment Mechanism	October 1969
No. 3	Financing State and Local Governments in the Seventies	June 1970
No. 4	Housing and Monetary Policy (out of print)	October 1970
No. 5	Consumer Spending and Monetary Policy: The Linkages	June 1971
No. 6	Canadian-United States Financial Relationships	September 1971
No. 7	Financing Public Schools (out of print)	January 1972
No. 8	Policies for a More Competitive Financial System	June 1972
No. 9	Controlling Monetary Aggregates II: The Implementation	September 1972
No. 10	Issues in Federal Debt Management	June 1973
No. 11	Credit Allocation Techniques and Monetary Policy	September 1973
No. 12	International Aspects of Stabilization Policies	June 1974
No. 13	The Economics of a National Electronic Funds Transfer System	October 1974
No. 14	New Mortgage Designs for Stable Housing in an Inflationary Environment	January 1975
No. 15	New England and the Energy Crisis (out of print)	October 1975
No. 16	Funding Pensions: Issues and Implications for Financial Markets	October 1976
No. 17	Minority Business Development	November 1976
No. 18	Key Issues in International Banking	October 1977
No. 19	After the Phillips Curve: Persistence of High Inflation and High Unemployment	June 1978
No. 20	Managed Exchange-Rate Flexibility: The Recent Experience	October 1978
No. 21	The Regulation of Financial Institutions	October 1979
No. 22	The Decline in Productivity Growth	June 1980
No. 23	Controlling Monetary Aggregates III	October 1980
No. 24	The Future of the Thrift Industry	October 1981
No. 25	Saving and Government Policy	October 1982
No. 26	The Political Economy of Monetary Policy: National and International Aspects	July 1983
No. 27	The Economics of Large Government Deficits	October 1983
No. 28	The International Monetary System: Forty Years After Bretton Woods	May 1984
No. 29	Economic Consequences of Tax Simplification	October 1985
No. 30	Lessons from the Income Maintenance Experiments	September 1986
No. 31	The Merger Boom	October 1987
No. 32	International Payments Imbalances in the 1980s	October 1988
No. 33	Are the Distinctions between Debt and Equity Disappearing?	October 1989
No. 34	Is There a Shortfall in Public Capital Investment?	June 1990
No. 35	The Financial Condition and Regulation of Insurance Companies	June 1991
No. 36	Real Estate and the Credit Crunch	June 1992

Federal Reserve Bank of Boston
P.O. Box 2076
Boston, Massachusetts 02106-2076

Address Correction Requested

Bulk Rate
U.S. Postage
PAID
Richmond, VA
Permit No. 930