Federal Reserve Bank of New York

Quarterly Review

Summer 1992 Volume 17 Number 2

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Federal Reserve Bank of New York Quarterly Review

Summer 1992 Volume 17 Number 2

Table of Contents

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table of Contents

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Rebuilding the Financial Strength of the U.S. Banking System

by E. Gerald Corrigan

I am delighted to have the opportunity to address this distinguished audience. Once again, Si Keehn and his colleagues deserve an enormous amount of credit for organizing a timely and stimulating program.

The topic assigned to me for my remarks today—"The Economic Implications of the Declining Importance of Banks"—is not one that I would have chosen because it is not at all clear to me that banks are of declining importance. Indeed, I would argue that certain of the *functions* performed by banks are no less important—and may be more important—today than was the case in the past. In saying that, I am quite familiar with the mass of statistics that show falling market share for banks in virtually all aspects of lending and credit extension. I am also quite familiar with the fact that other elements of the bank "franchise," including the deposit-taking function and the operation of the payments system, have been eroded by a combination of regulatory, technological, and competitive forces.

However, I still believe that banks are special, even though I suspect there are more than a few in this audience who would regard that point of view as old-fashioned, wishful thinking on my part. Perhaps that is so, especially in a setting in which we would all accept the fact that the decade of the 1980s was surely the most difficult such interval faced by the U.S. banking system since the 1930s. Indeed, the legacy of the 1980s that produced a weakened and vulnerable U.S. banking system resulted from a combination of (1) rising asset quality problems, (2) rapidly rising operating costs, (3) competitively depressed margins and spreads, (4) weakened capital positions, and (5) an underlying banking structure that was (and is) increasingly out of step with the realities of the marketplace here and abroad. To some extent, those sources of weakness and vulnerability were muted as long as overall economic activity remained relatively robust. However, when the pace of economic activity slowed beginning in 1989, the scope of the problem became more evident, as eventually reflected in the sharp fall in many bank stock prices and the very appreciable widening of spreads on bank debt relative, for example, to Treasury securities.

The legacy of the 1980s that produced a weakened and vulnerable U.S. banking system resulted from a combination of (1) rising asset quality problems, (2) rapidly rising operating costs, (3) competitively depressed margins and spreads, (4) weakened capital positions, and (5) an underlying banking structure that was (and is) increasingly out of step with the realities of the marketplace here and abroad.

Recently, there has been a pronounced reversal of those earlier trends in that equity and debt markets have favorably reappraised the outlook for banking institutions. This reappraisal seems to be driven by a number of factors:

- First, there are straws in the wind to suggest

Remarks before the Federal Reserve Bank of Chicago's Conference on Bank Structure and Competition, Chicago, Illinois, May 7, 1992.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

that the rise in problem assets in the banking system may have peaked, even though it is true that the level of problem assets remains very high by any historical standard. Certainly the LDC debt problem is now largely behind most major banks, and the highly leveraged transactions situation looks better on the whole, even though some individual problems still loom large. The commercial real estate problems remain formidable, but even there the fall in commercial real estate prices seems to have abated in some parts of the country.

Certainly the LDC debt problem is now largely behind most major banks,and the highly leveraged transactions situation looks better on the whole, even though some individual problems still loom large.

If—and this remains a big if—the drag on bank earnings arising from the very high level of nonperforming and underperforming loans begins to abate, there is no question that it can have a favorable impact on bank profits and capital retention.

- Second, despite the enormous drag on capital resulting from charge-offs and loan-loss provisions, major banks have substantially bolstered their capital positions over the past several years. Indeed, the vast majority of major banks' risk-based capital ratios are now well in excess of the Bank for International Settlements (BIS) minimums—a result that many observers would have regarded as unreachable only a few years ago.

The vast majority of major banks' risk-based capital ratios are now well in excess of the Bank for International Settlements (BIS) minimums—a result that many observers would have regarded as unreachable only a few years ago.

In this regard, it should be stressed that the 1988 Basle Capital Accord was one of the truly major banking and bank supervisory events, not just for the 1980s but for the postwar period as a whole. Not only did it represent a major step in the direction of achieving a more level playing field in international banking and a major step in the direction of strengthening the hands of supervisory authorities, but it also made it more respectable for bank managers and directors to do what had to be done in any event, namely, to become more aggressive and innovative in bolstering capital positions.

The 1988 Basle Capital Accord was one of the truly major banking and bank supervisory events, not just for the 1980s but for the postwar period as well.

- Third, banking institutions are also becoming much more aggressive in their efforts to contain operating costs. To be sure, some of this is arising in the context of mergers, but even in the absence of such events, individual banks are having a significant degree of success in curbing operating costs. This process is painful and difficult, perhaps especially for the tens of thousands of workers who are being displaced as a part of the effort. However, its potential implications for the "bottom line" and for competitive positions of individual institutions could be very powerful, especially if the drag on earnings arising from nonperforming loans were to abate materially.

This process [of containing operating costs] is painful and difficult, perhaps especially for the tens of thousands of workers who are being displaced as a part of the effort. However, its potential implications for the "bottom line" and for competitive positions of individual institutions could be very powerful.

Rebuilding the financial muscle of the U.S. banking system will be a long and difficult process that is far from risk free.

While these and other factors go a long way in explaining the reappraisal by debt and equity markets of the outlook for banks and the banking system, the fact remains that rebuilding the financial muscle of the U.S. banking system will be a long and difficult process that is far from risk free. Uncertainties about the near-term economic outlook in the United States and in much of the world tell us that in rather unambiguous terms. But even if the national and international economy were

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

to perform in a satisfactory manner over the period ahead, the question still remains whether—as a matter of public policy—we should care what role the banking system will play in our economic and financial affairs over the longer term.

Some might answer that question by suggesting that the market and technological forces that have already undercut so much of the historic banking "franchise" are so powerful that we have no practical choice but to allow nature to take its course and quietly permit banks to follow the course of the dinosaurs. Others might suggest that we should somehow try, through legislation or regulation, to recreate a banking franchise along the broad lines of what we had in the past.

To be sure, structural reforms in the U.S. banking and financial system such as the repeal of McFadden, Douglas, and Glass-Steagall will not solve all of our problems, but they will help to create a legislative framework within which the process of change and adaptation can move forward in a more orderly and a more stable manner.

Neither of these approaches appeals to me. The latter—call it reregulation for short—simply will not work, and the former is, to my way of thinking, too risky as long as there is still another alternative. That other alternative, of course, would be for the Congress to enact the kind of progressive legislation I and others have been suggesting for years. To be sure, structural reforms in the U.S. banking and financial system such as the repeal of McFadden, Douglas, and Glass-Steagall will not solve all of our problems, but they will help to create a legislative framework within which the process of change and adaptation can move forward in a more orderly and a more stable manner.

There are any number of reasons that the alternative of progressive and broad-based reform of our banking laws and regulations still strikes me as the most prudent and reasonable course for public policy. Most of those arguments have been cited over and over as the debate on this subject has dragged on for years. I do not intend to repeat those arguments in any detail today, but I would like to call your attention to two aspects of the debate that I believe are often ignored or downplayed:

Given the structural changes in banking and finance that have occurred in virtually all industrial countries, the prevailing banking structure in the United States is simply out of step with banking structure in the rest of the world.

- First, given the structural changes in banking and finance that have occurred in virtually all industrial countries, the prevailing banking structure in the United States is simply out of step with banking structure in the rest of the world. The competitive implications of this situation aside, our current arrangements are going to make it increasingly difficult to administer a policy of national treatment in our relationships with other countries. That is, as U.S. financial firms operating abroad benefit from the added flexibility available to them in other countries, foreign firms and their governments may—and probably will—become increasingly frustrated with the barriers they face in the United States. This situation brings with it the potential for new and avoidable tensions between nations in a setting in which trade and other economic and financial tensions between nations are already too high.

While the banking franchise is not what it once was, it remains true that the banking system performs certain unique functions that are important to our economic and financial well-being.

The banking system remains the lender of next to the last resort—a function we saw performed in almost textbook fashion at the time of the 1987 stock market crash.

- Second, while the banking franchise is not what it once was, it remains true that the banking system performs certain unique functions that are important to our economic and financial well-being. For example, the banking system remains the lender of next to the last resort—a function we saw performed in almost textbook fashion at the time of the 1987 stock market crash. Similarly, even though there are now important elements of payments and settlement systems operating outside the traditional banking system, in one way or another all of those payments and settlement systems still depend on the banking system to achieve true finality, and/or they depend on the banking

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

system for backup sources of liquidity, especially in times of stress. Finally, it is by no means clear to me that many of today's capital market instruments would enjoy the widespread market acceptance that is now the case were it not for the role of various forms of credit enhancement or backup liquidity facilities provided by the banking system.

In citing these functions performed by the banking system, I recognize that an argument could be made that some other class of institutions might—with the passage of time—be able to fill the void in the absence of a viable system of commercial banking. That may be true, but I, for one, believe it would be imprudent to leave to chance how well and by whom these activities would be performed if the banking system became so weak and so impotent that it could not step up to the task, especially in times of stress.

Payments and settlement systems still depend on the banking system to achieve true finality, and/or they depend on the banking system for backup sources of liquidity, especially in times of stress.

For these and other reasons I still believe it is important that we seek to encourage and maintain a financial system that has a strong and competitively viable banking system at its core. To be sure, the precise nature of the banking franchise will continue to evolve in ways that are not always foreseeable. But to assume or to conclude that we are destined to live with some other, unspecified system strikes me as potentially very dangerous, especially in circumstances in which the initial steps in rebuilding the financial strength of the banking system seem to be taking hold and in circumstances in which we have hardly exhausted the legislative and regulatory remedies capable of further strengthening the competitive and financial position of the banking system.

I still believe it is important ... to encourage and maintain a financial system that has a strong and competitively viable banking system at its core.

With a lot of discipline and vision on the part of bankers, regulators, and legislators—and perhaps with a little luck—the U.S. banking and financial system might emerge from the agony of the eighties with newfound strength and vitality. This will permit the banking system to perform those crucial functions that are so central to financial and economic stability, even as those institutions are better able to earn reasonable returns on capital—returns that, at the end of the day, must be there. If the returns are not there, the capital will not be there either!

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

A Comparison of Monetary Policy Operating Procedures in Six Industrial Countries

by Bruce Kasman

The institutional environments in which the central banks of the industrial world operate have changed substantially since the mid-1970s. Financial market liberalization, along with regulatory and technological change, has altered the relationships between central bank policy tools and objectives. Authorities have responded to these changes by revising the techniques and procedures they use to implement monetary policy. In Japan and France, where far-reaching reforms of the financial system have taken place, central bank operating procedures have been substantially transformed. In countries where well-developed capital markets existed earlier, the revisions in monetary policy operating procedures have been considerably less dramatic.

As financial liberalization and innovation proceed, the institutional settings of the central banks are becoming more uniform. Although arrangements still vary across countries, this convergence suggests that a comparison of central bank operating procedures is now likely to be of greater relevance to policy makers than at any time in the past.

An assessment of foreign practices may provide a particularly useful perspective on the changing conditions affecting the operations of the Federal Reserve's Open Market Desk. A noticeable increase in banks' reluctance to borrow at the Federal Reserve's discount window in recent years has at times contributed to large daily fluctuations in the federal funds rate. Moreover, reductions in reserve requirements in 1990 and April of this year have led to occasional conflicts between the Desk's reserve management strategy and more volatile day-to-day conditions in the funds market. With other central banks offering a wide variety of alternative techniques for implementing policy and a number currently operating in an environment of low, nonbinding reserve requirements, an examination of operating procedures followed by foreign central banks seems timely.[1]

This article describes monetary policy operating procedures in six industrial countries—the United States, Japan, Germany, the United Kingdom, Canada, and Switzerland. The object is to shed light on central bank strategies elsewhere in the industrial world and to compare them with the practices of the Federal Reserve. As part of this review, particular attention is given to the institutional environments in which central banks operate. The intermediate and ultimate objectives of a central bank, while important in an overall survey of monetary policy transmission, are not discussed in any detail.

Our review suggests that basic central bank intervention strategies are currently quite similar across the industrial world. Nearly all the central banks analyzed use interest rate operating objectives to guide their daily activities. In addition, although the central banks employ different instruments, they all implement policy principally through daily operations supplying or absorbing reserves at market-determined prices.

The Federal Reserve and several foreign central banks are also alike in having chosen to lower their reserve requirements in recent years. In most cases, the foreign monetary authorities have adjusted their operating procedures to accommodate this change.

[1] A good discussion of Federal Reserve operating procedures following the reduction in reserve requirements can be found in "Monetary Policy and Open Market Operations during 1991," this *Quarterly Review*, Spring 1992, pp. 72-95.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Specifically, they have provided a more elastic intraday supply of central bank reserves, largely through their credit facilities. In this way, they have limited any tendency for reduced reserve margins to lead to higher day-to-day interest rate volatility.

Our analysis suggests that some of the practices observed abroad might be helpful in limiting the short-run volatility of the federal funds rate in the United States. However, our analysis also indicates that the volatility of the federal funds rate, although higher since the 1990 cut in reserve requirements, remains low relative to that of comparable rates in most other countries. Moreover, we find no evidence that federal funds rate variability, within its current range, is transmitted to other money markets. Thus, the rise in interest variability that has accompanied the reduction in reserve requirements in the United States has probably not materially affected the monetary policy transmission mechanism.

Comparing operating procedures in six industrial countries[2]

Key features of central bank operating procedures

A central bank must choose implementation procedures that enable it to achieve its macroeconomic goals. Although the six central banks considered in this article have different objectives and operate under varied institutional environments, the key features of their implementation strategies are currently quite similar.

All six central banks implement policy by controlling the aggregate level of reserves available to the banking system. Although they are not in a position to control movements in all components of their balance sheets, particularly those related to their function as banker to the government and their holdings of foreign currency reserves, these banks currently have sufficient information and operational leeway to neutralize the effects of other activities and regulate the aggregate supply of reserves with a high degree of control.

In managing the reserve position of the banking system, central banks generally pursue short-run operating objectives. Operating objectives link reserve management activities to the intermediate and ultimate goals of policy and, in most countries, are also used to signal central bank policy intentions to market participants. Ideally, the authorities exert close control over operating objectives.

Bank reserves have served as an operating objective, but the relationship between reserves and economic activity generally has been viewed as too volatile for reserves to function as an effective short-run guide to policy. Most of these central banks have instead geared their reserve management activities toward short-term interest rate objectives.[3] A wide variety of money market interest rates are employed as operating objectives. Nonetheless, influence over overnight interest rates is a goal common to the daily activities of all six of these central banks. Each of these countries has a well-functioning interbank money market where individual banks trade reserves on deposit at the central bank.[4] If the aggregate supply of banking system reserves does not correspond to demand, the cost of overnight funds in this market is immediately affected.

Although central banks' reserve management activities give them considerable control over short-term interbank rates, their influence on interest rates must extend to maturities well beyond overnight rates to affect economic activity. Central bank influence over longer term rates is indirect and principally determined by market forces. Through arbitrage, longer term rates reflect market expectations of future short-term rates. A central bank's leverage over longer term rates is obtained largely through its influence on these expectations. By taking steps to communicate credible intentions about the range in which overnight and other short-term interest rates should trade in the future, central banks can transmit their interest rate policies throughout the money market term structure and beyond.

To this end, most of these central banks limit themselves to infrequent adjustments in their operating objectives. Targeted interest rates are generally changed in small steps and only after a sufficient amount of new information has accumulated to warrant a change in policy. By encouraging expectations of interest rate stability over a medium-term horizon, policy makers gain influence over rates throughout the term structure.

Although interest rate operating objectives have been prevalent among these central banks over the past two decades, the type of implementation strategy employed

[2]The discussion in this section benefited from exchanges with staff members of each of the five foreign central banks. Any errors of fact or interpretation are, of course, the responsibility of the author.

[3]The notable exception is the Swiss National Bank, which has maintained bank reserve operating targets. In addition, the Federal Reserve experimented briefly with nonborrowed reserve objectives from 1979 to 1982. The choice of monetary policy operating targets has been the subject of considerable debate. William Poole provides the seminal discussion of these issues in "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, vol. 84 (1970), pp. 197-216. For a recent discussion of interest rate operating objectives in the United States, see Marvin Goodfriend, "Interest Rates and the Conduct of Monetary Policy," and the accompanying comments by William Poole in *Carnegie-Rochester Conference Series on Public Policy*, no. 34 (1991), pp. 7-39.

[4]In Japan and the United Kingdom, nonbank financial intermediaries participate in the interbank market. In Canada, an important overnight market in call loans, used by both banks and investment dealers, exists alongside the interbank market.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

has, in many countries, evolved considerably.[5] During the 1970s, the central bank of Japan and several European central banks relied heavily on a system of administered interest rates to implement policy. Banks' marginal reserve demand in these countries was largely met through central bank credit facilities, often at below-market rates.[6] "Official" or tightly controlled money market rates served as anchors for regulated deposit and lending rates. Together with other controls over financial activity, official rate changes were transmitted largely through their direct effect on bank credit availability.

This approach came under pressure in the late 1970s. The delays by some central banks in adjusting interest rates to counter a buildup of inflation in the late 1970s raised concerns about the inflexibility of interest rate determination. Many observers believed that the use of highly visible official rates constrained banks from adjusting policy in a timely fashion. More important, however, rising inflation helped spur the liberalization of financial markets, which in turn substantially increased the importance of competitive forces in determining interest rates. Domestic financial markets also became more closely integrated with foreign markets. As a consequence, market-determined interest rates and exchange rates played an increasingly central role in private agents' expenditure decisions.[7]

Although procedural changes have been greatest in those countries where financial change has been most significant, the central banks under review have in general moved towards market-oriented methods for implementing monetary policy. As noted earlier, authorities increasingly rely on market-determined interest rates both as operating objectives and as key elements in the transmission mechanism. At the same time, market operations, in which central banks intervene in financial markets at freely determined prices, have gradually replaced lending and regulatory controls as the principal instrument for altering reserve supplies in most countries.

The shift toward market-oriented interest rate objectives has helped the central banks to reduce the repercussions arising from changes in their policy stance. In addition, open market operations permit central banks to exercise considerable discretion in the day-to-day management of reserves. While relying on market forces to determine interest rates, central banks can intervene at select times to influence the range within which rates move. Furthermore, the wide variety of available domestic money market instruments (whose development was greatly encouraged by monetary authorities in most countries) allows the banks to construct intervention strategies that span the money market term structure.

In practice, central banks continue to severely limit the range in which short-term interest rates fluctuate. By fine-tuning their market operations, usually on a daily basis, these central banks alter reserves to accommodate variations in reserve demand.

This active effort to moderate even transitory interest rate fluctuations underscores central banks' desire to communicate their policy intentions clearly to market participants. In nearly all the countries under review, the stance of monetary policy is signaled through interest rates. Market interest rates respond to developments other than policy changes, however, and movements unrelated to policy must be filtered out before policy inferences can be drawn. By sharply limiting interest rate variations daily, central banks ensure that market participants can clearly identify interest rate targets and quickly ascertain changes in the monetary policy stance.

To implement an interest-rate-based operating policy through periodic open market operations, central banks must be able to predict the demand for bank reserves over some relevant horizon. Banks need reserves to meet reserve requirements and to make interbank payments. Central banks have considerable influence over reserve demand through their role in setting reserve requirements and interbank clearing rules. Specific rules (lagged reserve accounting, reserve averaging, and carryover provisions) and payment systems practices (timing of payments, overdraft provisions) have been designed, in part, to strengthen and stabilize the short-term demand for bank reserves. In general, the stability of reserve demand over a maintenance period has been a key element underlying central bank implementation procedures.

In the past, many central banks actively managed reserve demand by changing reserve requirements and applying other administrative controls to bank behavior. These practices have greatly diminished in recent years, a change that in part reflects the general trend towards market-based policy strategies. At the same time, all six central banks have reduced reserve requirement ratios over the past decade in an attempt to lighten the burden they place on banks. In some coun-

[5] An excellent discussion of how monetary policy procedures have evolved can be found in J.T. Kneeshaw and P. Van den Bergh, "Changes in Central Bank Money Market Operating Procedures in the 1980s," *BIS Economic Papers*, no. 23, January 1989.

[6] Reliance on subsidized central bank credit sources for bank reserve needs characterized German, Japanese, and Swiss monetary policy.

[7] A detailed analysis of financial innovation and its effect on the monetary policy transmission mechanism can be found in *Financial Innovation and Monetary Policy*, Bank for International Settlements (Basle, 1984).

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

tries, the relaxation of restrictions on banks' reserve holdings has led to greater variability in reserve demand, compelling authorities to adjust their reserve management procedures.

Although this overview of the key features of central bank implementation strategies suggests broad similarities across countries, the specific techniques employed by individual central banks to implement monetary policy vary greatly. Central bank market operations span a wide spectrum of assets and maturities; the timing of operations and the frequency with which they are conducted also differ. Significant differences can be seen as well in the conditions determining access to central bank credit, the regulations setting required reserve levels, and the length of time granted depository institutions to meet their obligations.

In many cases, these differences are institutional in nature, reflecting the particular environments in which central banks operate. For example, in conducting open market operations, central banks must depend on the markets available to them. Where active secondary security markets have not developed, central banks may need to make special arrangements for implementing their reserve management policies.

The remainder of this section compares monetary policy implementation techniques across the six countries. By examining the particular institutional environment in which each central bank operates and by observing the interaction of the specific instruments central banks employ—open market operations, central bank lending policy, and reserve requirements—one can identify meaningful differences between Federal Reserve and foreign central bank operating procedures.

Operating objectives and procedures

All six central banks gear their short-term reserve management activities toward influencing interest rates, but specific interest rate strategies differ from bank to bank. The Federal Reserve in the United States limits its activities to influencing overnight interbank rates (the federal funds rate), allowing market forces to determine the transmission of policy to other financial markets. The Swiss National Bank also acts to smooth daily fluctuations in overnight interbank rates, but it is unique among these central banks in setting no explicit interest rate operating objective. Although the four other central banks also actively intervene to smooth fluctuations in overnight rates, they generally seek to influence money market rates of longer maturities as well. In Japan, overnight interbank rates remain the primary operating objective of the central bank, while in Canada, Germany, and the United Kingdom, interest rates of longer maturity, up to three months in some cases, are employed as the primary operating objective. A summary of the interest rates important to the banks' policy implementation is presented in Table 1. The primary interest rate operating objective for each country is highlighted.

Of the central banks considered, the Bank of England (BOE) is probably most active in its daily reserve management activities. Operating in an environment in which reserve requirements are low and banks try to maintain a specific daily level of operational balances at the BOE, the Bank has developed a strategy of frequent intraday interventions in money markets to achieve its interest rate objectives.[8]

Each morning at 9:45 a.m. the BOE announces its estimate of the net reserve position of the banking system for the day. Based largely on expected government transactions and the BOE's maturing stock of short-term bills, these estimates signal the amount of reserves that the BOE anticipates must be supplied to bring actual balances of clearing banks to the levels the banks are expected to maintain.[9]

Because the bulk of the BOE's assets are in short-term bills (commercial or Treasury) that mature in less than three months and that do not roll over automatically, the banking system will usually be projected to have a "cash shortage" at current interest rates. To meet this shortage, discount houses, which serve as intermediaries between the BOE and private banks, are invited to offer bills to the Bank for purchase, indicating the price at which they are willing to sell.[10] The BOE buys bills to meet the estimated shortage in four maturity bands: zero to fourteen days, fifteen to thirty-three days, thirty-four to sixty-three days and sixty-four to ninety-one days. It chooses the best prices offered but holds unchanged the minimum dealing rate (stop rate) on Band 1 bills maturing in up to fourteen days. As many as three rounds of these operations may take place in a day, enabling the BOE to respond to changing intraday market conditions. If late-day imbalances arise, they are met through credit facilities available to discount houses.

By purchasing bills across bands (maturities), the BOE attempts to extend its influence over interest rates

[8]To assist the BOE in its daily forecast of the reserve position of the banking system, each clearing bank is obliged to specify the size of reserve balances that it will try to maintain daily.

[9]The government holds most of its balances with the BOE. Because its daily transactions with the rest of the economy are large and fluctuate widely, the BOE's forecast of net government flows is both the key component of this estimate and the greatest source of uncertainty.

[10]For more detailed information on the role of discount houses in the U.K. financial system and the BOE's money market operations more generally, see "Bank of England Operations in the Sterling Money Market," *Bank of England Quarterly*, October 1988.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

throughout the money market. Variations in the amount of bills purchased in Band 4 (sixty-four to ninety-one days), for example, tend to have a strong influence on three-month Treasury bill rates. The BOE also has the option of offering repurchase agreements to discount houses on its own terms if it does not wish to validate the rates being offered. Mindful of this option, the discount houses will generally offer prices embodying their expectation of the BOE's desired rate objectives.

The stop rate changes infrequently. Movements in this rate signal a shift in BOE policy and are usually reflected immediately throughout the interbank market and in commercial bank base lending rates (Chart 1). On occasion, the BOE will send a strong signal of its intention to shift policy by choosing not to accommodate a shortage in reserve needs during the day, thereby obliging discount houses to borrow from the BOE at terms announced by the Bank. Since the BOE has the flexibility to set this lending rate either above or below current stop rates, it can use this procedure to signal a tightening or an easing in policy.

Japanese monetary authorities followed a similar strategy of tight control over the key intervention rate until the early 1980s. Combining reserve management operations with administrative control over interbank market participants, the Bank of Japan (BOJ) was able to stabilize the call-money overnight interbank interest rate at the level desired for long periods. As part of a broader reform of financial markets over the past decade, the BOJ has actively promoted integration of the interbank with other financial markets and encouraged greater flexibility of interbank interest rates, particularly on an intraday basis.[11]

The overnight call rate remains the BOJ's key operating objective, and although it is subject to greater influence from market forces than in the past, the BOJ still actively strives to limit its fluctuations around the targeted level (Chart 2). The BOJ implements this policy through a variety of market operations, primarily transactions in commercial bills, and through its daily management of discount window credit. Control over the "reserve progress ratio," which measures reserves accumulated by banks relative to those required within a maintenance period, is a key element of this policy. Upward pressure on interest rates is effected by supplying fewer reserves than are necessary for the reserve progress ratio to rise at an average pace.

[11]For a detailed analysis of the evolution of Bank of Japan policy and references to the literature on financial market liberalization in Japan, see Bruce Kasman and Anthony P. Rodrigues, "Financial Liberalization and Monetary Control in Japan," this *Quarterly Review*, Autumn 1991, pp. 28-46.

Table 1

Structure of Short-Term Interest Rates

Country	Official Rates	Overnight Interest Rates	Other Key Interest Rates
United States	Discount rate	**Federal funds rate**	Treasury bill rate
Germany	Discount rate Lombard rate Treasury bill selling rate	Day-to-day money rate	**Repurchase agreement rate (one- to two-month)** Three-month interbank loan rate
Japan	Discount rate	**Interbank call money rate**	Certificate of deposit rate (three-month) Bill discount rate
United Kingdom	No posted rate	Overnight interbank rate	**Bank of England minimum dealing rate (Band 1 bills)** Commercial bank base lending rate Three-month interbank loan rate
Canada	Bank Rate	Money market financing rate	**Three-month Treasury bill tender rate** Ninety-day prime corporate paper rate
Switzerland†	Discount rate Lombard rate	Call money rate	Three-month Euro-franc deposit rate

Note: Each central bank's primary interest rate objective appears in boldface type.
†The Swiss National Bank does not employ interest rate operating objectives.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Banks have considerable leeway in managing their reserve positions because the reserve maintenance period is a full month in Japan. Nevertheless, changes in the reserve progress ratio clearly convey the BOJ intentions concerning future interest rates and, as a result, usually lead to a quick response in overnight interest rates.

The evolution of BOJ policy over the past decade reflects a movement towards procedures long followed by the Federal Reserve System. Indeed, the two central bank implementation strategies appear quite similar in their basic characteristics—an overnight interbank rate operating objective, the use of market operations and discretionary central bank lending facilities as policy instruments, and a focus on reserve management over a maintenance period.

Still, important differences remain between the operating strategies of the Bank of Japan and the Federal Reserve. While the Federal Reserve conducts most of its daily operations in the repurchase market for government securities, the BOJ relies on a variety of private market instruments, including commercial bills, commercial paper, and certificates of deposit. In part, the BOJ's reserve management activities reflect the limited development of a single short-term government securities market in Japan. However, the BOJ has also employed operations in different instruments to exert direct influence on money market interest rates. Up until 1988 interbank and other open markets were not fully integrated, and the BOJ intervened actively in longer term money markets, primarily to influence the three-month certificate of deposit rate.

Following a period in 1987 and 1988 in which open market rates moved well above comparable rates in the interbank market, the BOJ implemented a series of reforms to facilitate arbitrage across short-term money markets.[12] Since that time, the BOJ has generally limited its efforts to influence interest rates in the interbank market to instruments of seven days' maturity or less. Market operations in longer term money market instruments are now primarily designed to offset seasonal fluctuations in reserve demand.

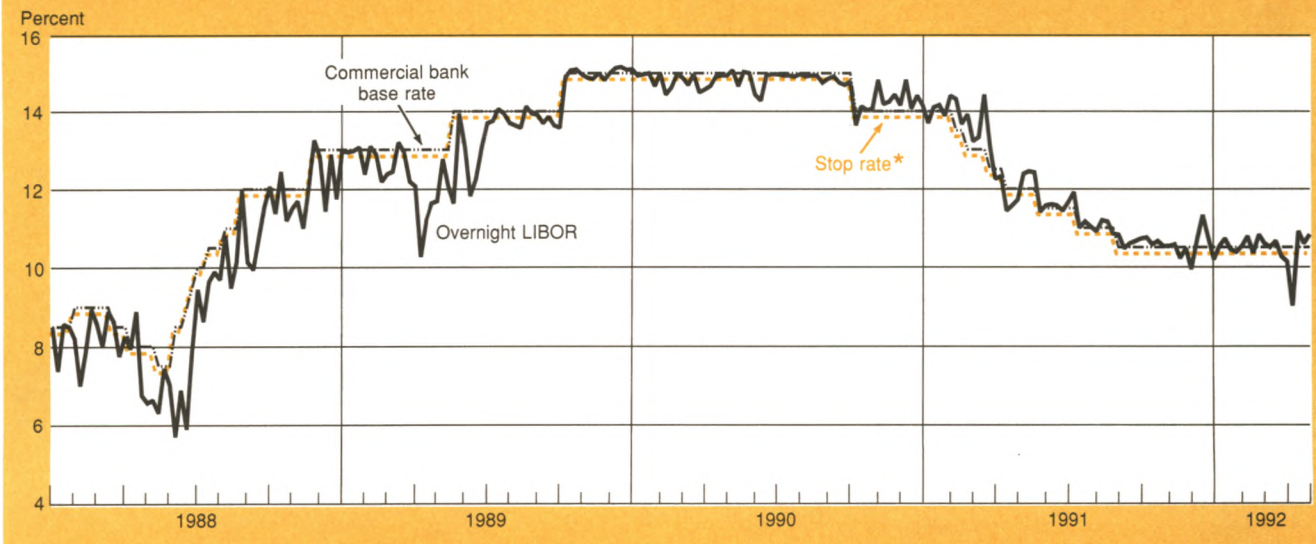
The administration of discount window lending also differs considerably in the two countries. In the United States, banks initiate the decision to borrow at the Federal Reserve's discount window, and borrowing is

[12]For a detailed discussion of money market reforms implemented since 1988, see *Japan's Short-Term Money Market and Issues*, Ministry of Finance and Bank of Japan, Money Market Study Group, August 1991.

Chart 1

United Kingdom: Short-Term Interest Rates

Weekly Observations, Wednesdays



*The stop rate is the Bank of England's minimum dealing rate on Band 1 bills.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

rationed through a set of administrative guidelines. In Japan, the BOJ decides on the level of bank borrowing and the length of loans (a factor that determines the effective cost of a loan). In administering discount window lending, the BOJ actively manages loan provision on a daily basis to respond to intraday fluctuations in reserve positions. The BOJ is unique among the central banks surveyed in employing lending as a discretionary instrument of daily reserve management.

The institutional environment in which the Swiss National Bank (SNB) operates has undergone considerable change in recent years. From 1980 through 1988 the SNB guided its policy largely with short-term bank reserve targets. Although interbank interest rates fluctuated widely on a daily basis, the SNB was reasonably successful in achieving its primary policy objective of maintaining low rates of inflation.[13]

In 1988, the combined effects of implementing an electronic payment system for the settlement of interbank cash balances (1987) and introducing new liquidity rules (January 1988) led to a sharp decline in bank reserve demand (Chart 3).[14] The difficulties faced by the SNB in predicting the size of this decline led to an unwanted expansionary monetary policy in early 1988. In response, the SNB shifted its operating objectives away from reserves toward short-term interest rates and exchange rates.[15] Although the SNB has gradually moved back towards an implementation strategy based on operational targets for bank reserves, it has continued to emphasize interest rates in its daily operating procedures.

Each quarter the SNB signals its short-term policy intentions by announcing a forecast of the level of the monetary base in the subsequent quarter.[16] Incorpo-

[13]See Ben Bernanke and Frederic Mishkin, "Central Bank Behavior and the Strategy of Monetary Policy: Observations from Six Industrial Countries," National Bureau of Economic Research, Working Paper no. 4082, May 1992, for a recent assessment of Swiss monetary policy over the past two decades.

[14]The new liquidity rules lowered required reserves and shifted the maintenance period from the end of the month to a month average.

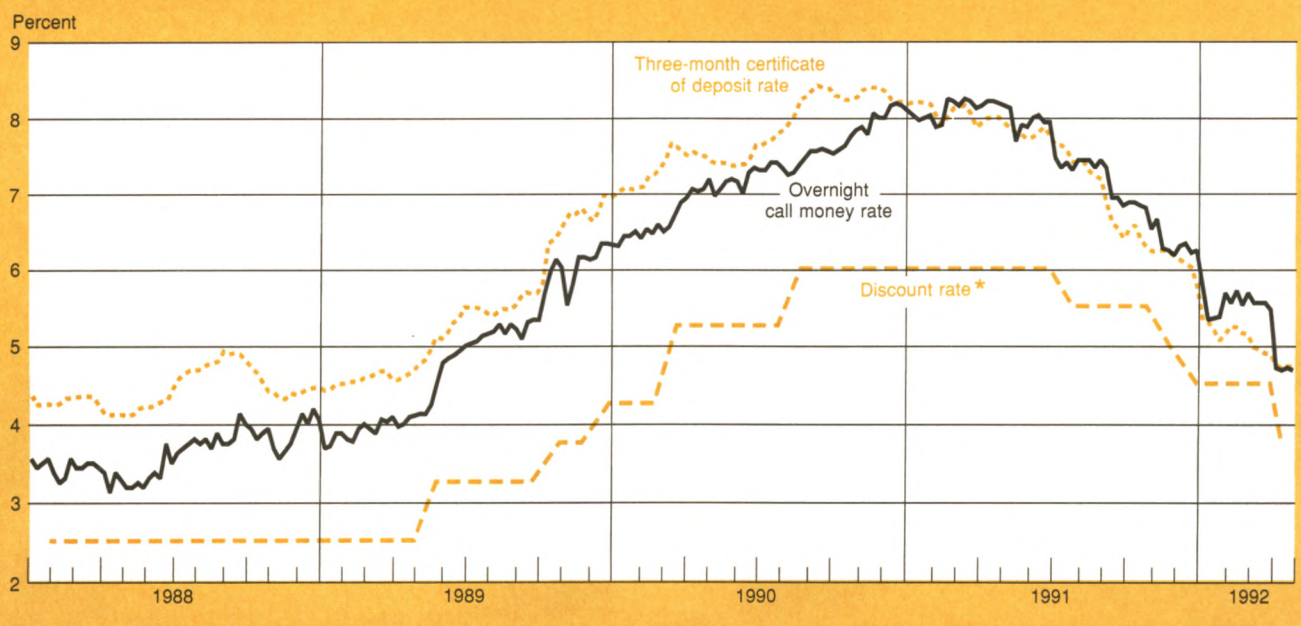
[15]See Organization for Economic Cooperation and Development, *OECD Economic Survey-Switzerland* (Paris, 1989), for a discussion of Swiss monetary policy following these institutional changes.

[16]The forecasts are designed to be consistent with medium-run growth targets for the monetary base. Since 1990, these medium-run targets have been defined as annual growth rates to be achieved over a period of three to five years. The targets thus give the SNB considerable flexibility in determining its quarterly forecasts.

Chart 2

Japan: Short-Term Interest Rates

Weekly Observations, Wednesdays



*Values are month-end observations.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

rated in this forecast is an unannounced operational target for the level of bank reserves held at the SNB. Although this target serves as a guide to policy operations over each month and each quarter, authorities have considerable discretion in deciding on their day-to-day activities. In implementing daily policy, the Bank largely seeks to smooth fluctuations in overnight interbank rates. Nonetheless, the interest rate policy of the SNB differs significantly from the policies of the other central banks under review. No operational targets are set for the level of interest rates, and the SNB does not employ interest rates to signal its stance to market participants.

The institutional changes that took place in Switzerland in the late 1980s have not led to substantial changes in the implementation procedures employed by the SNB. As before, market operations are generally conducted once each morning through foreign currency operations. These transactions, in the form of U.S. dollar-Swiss franc swaps, are conducted at rates close to those prevailing in Euromarkets and extend up to one year in maturity.

Earlier SNB restrictions, which placed limits on end-of-month Lombard lending and required banks to give advance notification of their credit needs, were removed when reserve requirements were reduced in 1988.[17]

[17]Before January 1988, banks' reserve requirements were monitored only on the last day of a month. Banks' demand for reserves consequently soared at this time. With access to Lombard lending limited by these restrictions, short-term interest rates often rose very steeply at month's end.

Nevertheless, in 1989 the Bank floated the Lombard rate 200 basis points above market rates, a move that has substantially limited recourse to this facility.

In Germany, interest rates on security repurchase agreements of one- to two-month maturities are the primary operating objective of the Bundesbank.[18] These rates are determined at periodic tenders typically conducted once a week. The Bundesbank normally determines the aggregate value of repurchase agreements offered at a tender by assessing market demand for reserves, and it chooses the best prices available. On occasion, it will fix the price (interest rate) at a tender to send a clear signal of its policy intentions to markets.[19]

Of the central banks considered, the Bundesbank is probably the least active in its daily reserve management activities. Repurchase agreement tenders generally provide the liquidity needed each day. Occasional

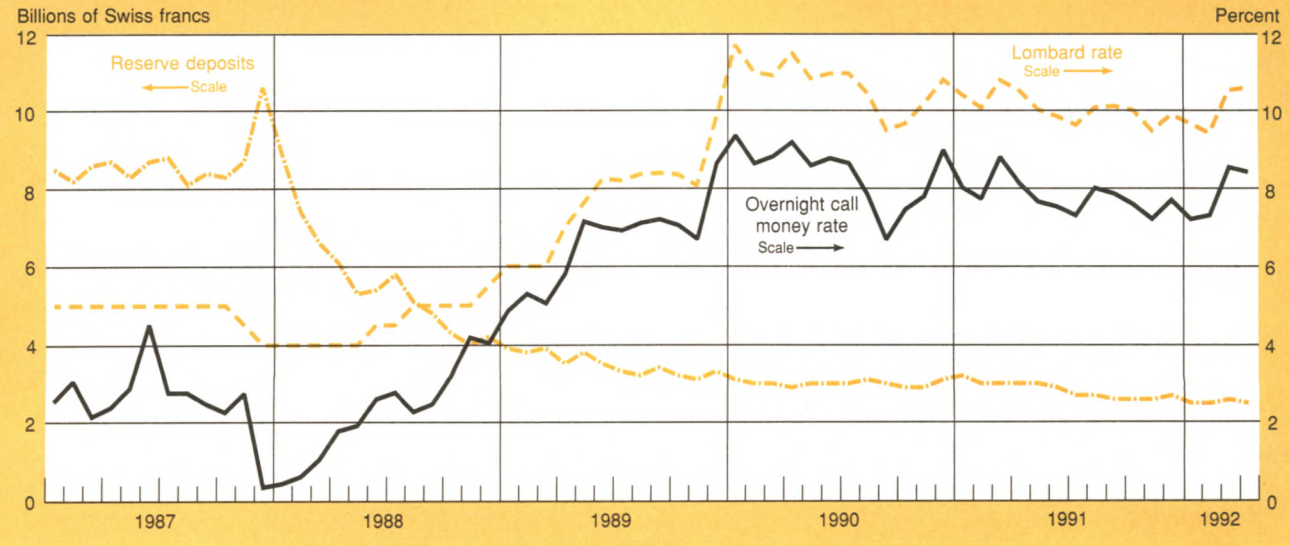
[18]For a recent discussion of Bundesbank operating procedures, see Andre Bartholomae, "Some Operational and Instrumental Aspects of Monetary Targeting in Germany," Deutsche Bundesbank, unpublished paper, 1991.

[19]For example, the Bundesbank employed "volume tenders" in which it set interest rates for several months following the October 1987 stock market crash.

Chart 3

Switzerland: Reserve Deposits and Interest Rates

Monthly Averages



Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

"supportive" operations are undertaken to influence the day-to-day money rate through a number of reversible fine-tuning measures. Short-term interest rate smoothing, however, is largely obtained through means other than market operations, a system that reflects the limited development of domestic money markets in Germany. Specifically, official rate facilities on Lombard loans and the Bundesbank's Treasury bill selling rate bound the range within which money market rates can fluctuate (Chart 4). In addition, high reserve requirement ratios and long (one-month) maintenance periods provide banks with considerable flexibility to arbitrage away transitory shocks to their reserve positions.

For the Bank of Canada (BOC), the three-month Treasury bill tender rate is the primary operating objective. The BOC participates in the weekly auction and buys and sells bills in the market from time to time, both on an outright and on a buy-back basis. But the BOC implements policy mainly through daily transfers of government demand deposits between the BOC and private banks.[20] These transfers are decided late in the day, by which time the BOC has information on government transactions and other payment items that might affect bank reserves. Thus, the BOC is able to determine end-of-day reserve positions with unusual precision, particularly because these "drawdowns" or "redeposits" of government balances occur too late for banks to make further adjustments to their balance sheets. These transfers have a direct effect on overnight rates in the call and interbank markets. Daily reserve management activities are geared, however, toward maintaining market conditions consistent with the BOC's weekly Treasury bill rate objective (Chart 5).

Key instruments of reserve management

Intervention tools vary widely across the central banks surveyed. In part, these instruments reflect the differing financial environments facing authorities in the six countries. The choice of instruments is, however, also related to specific objectives of reserve management and the means chosen by the authorities to signal their policy intentions to financial market participants. A summary of the market operations employed by the six central banks is presented in Table 2.

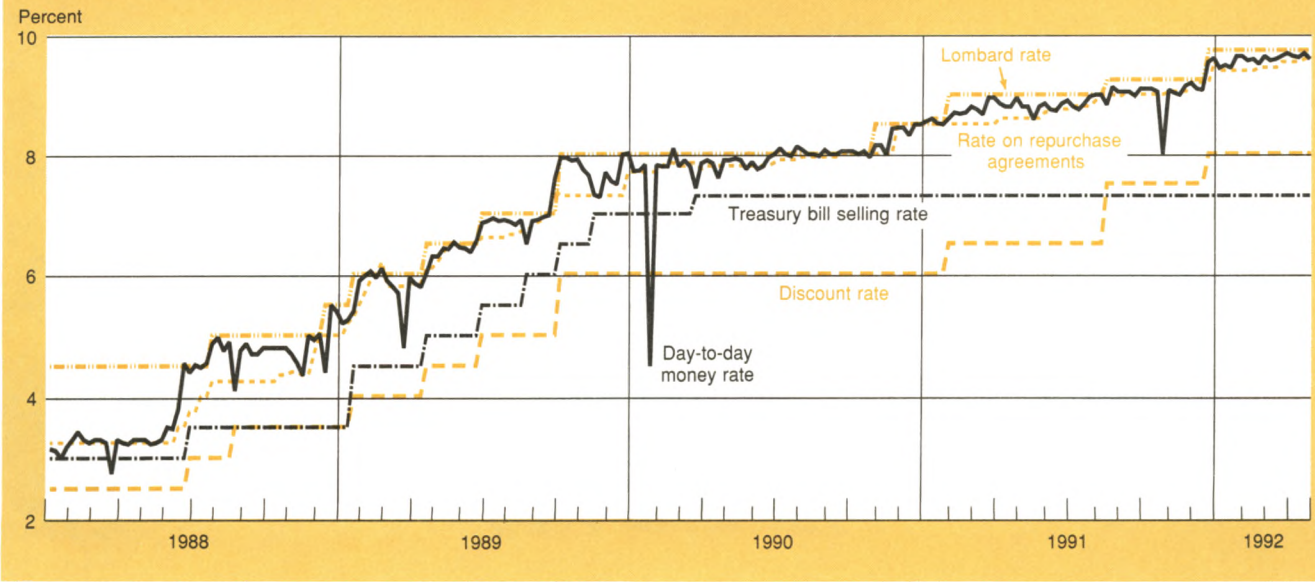
The U.S. Federal Reserve operates mostly in the secondary market for government securities. The prototypical open market operation, the outright purchase or sale of government securities in the secondary market, has long been the major instrument for providing permanent bank reserves in the United States. The breadth and depth of this market allow the Federal Reserve to add or drain large amounts of reserves

[20] A detailed description of these operations is found in Kevin Clinton, "Bank of Canada Cash Management: The Main Technique for Implementing Monetary Policy," *Bank of Canada Review*, January 1991, pp. 3-25.

Chart 4

Germany: Short-Term Interest Rates

Weekly Observations, Wednesdays



Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

without significantly distorting yield structures.

Although outright purchases of securities provide the primary source of secular reserve creation, the Federal Reserve typically conducts less than ten outright purchases and sales in the market each year.[21] On a daily basis, policy is implemented primarily through repurchase agreements (which add reserves) or matched sale-purchase agreements (which drain reserves). These

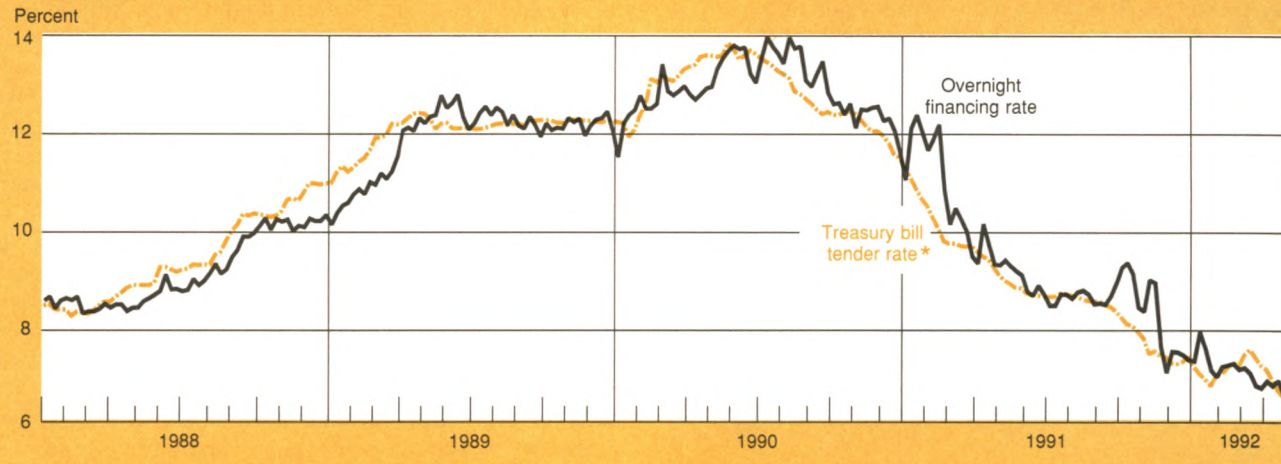
[21]The Federal Reserve does take advantage of purchase or sale

Footnote 21 continued
orders of foreign official accounts when these are consistent with reserve objectives.

Chart 5

Canada: Short-Term Interest Rates

Weekly Average



* Rate is determined at Thursday tender. The central bank lending rate (Bank Rate) is set 1/4 percentage point above this rate.

Table 2

Instruments for Reserve Management

	Primary Short-Term Reserve Management Tool		Other Operations	
Country	Activity	Instrument	Activity	Instrument
United States	Repurchase agreement	Government security	Purchase or sale	Government security
	Matched purchase and sale	Government security		
Germany	Repurchase agreement	Government security	Purchase or sale	Government security
			Foreign exchange	Swap
Japan	Repurchase agreement	Commercial bills, government security	Purchase or sale	Government security
	Discount window lending	———	Repurchase agreement	Commercial paper
United Kingdom	Purchase or sale	Commercial bills, government security	Repurchase agreement	Government security
Canada	Drawdown/redeposit	Government deposits	Purchase or sale or repurchase agreement	Government security
Switzerland	Foreign exchange	Swaps	Purchase or sale	Cantonal and bank bonds
			Drawdown/redeposit	Government deposits

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

reversed security transactions involve lower transactions costs than outright transactions and provide a much more flexible instrument for the temporary adjustment of reserve positions. They are conducted through a large existing private market and may range up to fifteen days in maturity, although they usually mature in one or a few days. Although most of these transactions are designed to smooth temporary fluctuations in reserve markets, they are also employed by the Federal Reserve to implement a change in its policy stance.

In Japan, Canada, and the United Kingdom, as in the United States, outright purchases of securities are the main asset counterpart to the expansion in the monetary base over time. In Japan, the purchase of ten-year government bonds meets the secular demand for reserves but is not important in short-term reserve management. The BOJ conducts a variety of other operations to affect reserve positions on a temporary basis. Outright and reversed transactions in commercial bills and other money market instruments are designed to offset seasonal and other short-term fluctuations in reserve demand. Discount window lending activities remain the primary tool to smooth unanticipated day-to-day fluctuations in reserve positions.

Canadian monetary authorities also employ a variety of instruments to achieve policy objectives. The BOC's weekly participation in the three-month Treasury bill tender and its purchases of long-term government bonds at issue are the principal asset counterparts of money base increases in Canada. On a day-to-day basis, the BOC's drawdown/redeposit mechanism, described earlier, is its primary instrument of reserve management. The distribution of drawdowns and redeposits among clearing banks is determined at twice-monthly auctions where banks bid competitively for allocation ratios of government demand deposits. Supplementing this mechanism are other market operations, including outright purchases of short-term government securities and repurchase agreements. All open market operations are, however, routinely neutralized by the BOC as part of its drawdown/redeposit activities. As a result, open market operations are geared toward directly influencing particular money market interest rates.

In the United Kingdom, BOE assets are held primarily in the form of short-term eligible bills. The BOE routinely purchases bills to roll over its maturing portfolio and to achieve its short-term reserve management objectives.[22]

[23]Eligible bills include Treasury bills and commercial bills carrying two established names, usually those of a British bank and a discount house. The BOE will buy or sell bills of up to three *months*' maturity and does conduct some reversed security transactions.

As noted earlier, BOE operations are designed to relieve daily money market shortages through the outright purchase of bills from discount houses. Although it typically maintains a fixed stop rate on Band 1 bills, the BOE generally does not relieve the entire shortage through Band 1 bill purchases. It conducts bill operations in maturities as long as three months, designing these operations to exert influence on rates throughout the money market term structure. In addition, the BOE can refuse to relieve shortages through bill purchases if it is unhappy with the rates being offered. In these circumstances, the BOE can offer repurchase agreements on its own terms or invite discount houses to use their borrowing facilities at 2:30 p.m. at a rate set at the BOE's discretion.[23]

Neither the Bundesbank nor the SNB holds significant portfolios of securities because well-developed short-term money markets do not exist outside the interbank market in Germany and Switzerland. In this environment, the Bundesbank uses central bank lending (mainly bills rediscounted) and bond repurchase operations as the major vehicles to augment the monetary base. The Bundesbank has established special provisions for reversed security transactions with banks; these transactions serve as the Bank's primary instrument of short-term reserve management. The Bundesbank conducts periodic tenders (usually weekly) for one- to two-month repurchase agreements. These repurchase agreements consist of a secular component and a component that makes temporary adjustments to reserve positions. Repurchase agreements have steadily increased as a share of Bundesbank assets since the mid-1980s, gradually supplanting discount window lending as the principal asset counterpart of the money base. Other instruments, such as foreign exchange swaps and the transfer of government deposits from the Bundesbank to banks, are employed when daily adjustments in reserve positions are deemed necessary.[24]

In Switzerland, the domestic securities market is extremely narrow. An active interbank swap market for major foreign currencies does exist, however, and the SNB employs currency swaps as the primary instrument of both permanent and temporary reserve operations. Conducted daily in the form of U.S. dollar-Swiss franc swaps with a small number of banks, these operations currently provide over 90 percent of the reserve creation

[23]The 2:30 borrowing differs from normal day-to-day late assistance in that the interest rates on loans are published and the amounts borrowed do not count against discount houses' borrowing facilities.

[24]Foreign exchange swaps are usually employed to neutralize an expansion in reserves resulting from international capital inflows. Transfers of government deposits between the Bundesbank and private banks are generally used to offset temporary reserve shortages associated with tax payments.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table 3
Central Bank Lending Facilities

	United States	Germany	Japan	United Kingdom	Canada	Switzerland
1) Credit available at below market rates	Yes	Yes	Yes	No	No	Yes
Access restricted by: Q = quotas, D = administrative discretion	Q,D	Q	Q,D	—	—	Q
Interest rate setting: P = posted rate D = set at discretion of central bank	P	P	P,D†			P
2) Other credit sources available	No	Yes	No	Yes	Yes	Yes
Access restricted by: Q = quotas, D = administrative discretion O = other	—	Q‡		D	O§	Q‡
Interest rate setting: F = Floats in relation to market rate P = Posted rate D = set at discretion of central bank	—	P		D	F	F

†The Bank of Japan provides credit at the official discount rate. The Bank can add or call loans at will, however, and interest charged is calculated on the period of the loan plus one day. The effective cost of borrowing thus rises as the maturity of a loan is reduced.

‡Generally nonbinding.

§Bank of Canada advances are provided only for an end-of-averaging-period reserve deficiency or for overdrafts to meet a deficiency of clearing balances.

for Swiss banks. Since the dollars purchased by the SNB are covered forward, these transactions are equivalent to temporary operations in domestic securities. Because swaps are settled with a two-day lag, the SNB supplements these activities with same-day shifts of government deposits between its books and those of private banks.

Central bank credit facilities

The monetary authorities in all six countries considered offer banks a facility for obtaining credit. The market operations described above, however, have largely replaced central bank credit as the major tool for short-term reserve management in these countries. At present, most central bank lending facilities are designed to meet unforeseen and temporary end-of-day liquidity shortages or to provide assistance for institutions in times of stress. Nonetheless, the role of lending in the six central banks' implementation strategies varies. A summary of key characteristics of central bank lending facilities is presented in Table 3.

In four of the countries considered (Germany, Japan, the United States, and Switzerland), a collateralized credit facility is made available to banks at below-market interest rates. In Germany, Japan, and Switzerland, discount window lending, determined by quotas, provides an ongoing source of subsidized funds to meet a portion of secular reserve demand. The Bundesbank's facility is particularly large, currently accounting for about one-quarter of total central bank assets (Table 4). The large volume of subsidized discount window lend-

Table 4
Central Bank Lending as a Share of Central Bank Assets
(Annual Average of End-of-Month Observations)

	1985	1988	1991
United States	0.7	0.9	0.1
Japan	8.4	13.6	12.1
Germany	29.4	22.5	25.0
United Kingdom	1.8	1.8	3.0
Canada	7.4	2.2	2.0
Switzerland	9.9	0.9	1.2

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

ing in Germany is designed, in part, to offset the costs to banks of high levels of required reserves.

Because German and Swiss banks fully use their quotas most of the time, discount window lending does not accommodate banks' unanticipated reserve needs in these countries. Both the Bundesbank and the SNB provide an additional line of credit at a penal rate to meet unexpected short-term liquidity needs. These facilities, called Lombard loans, effectively cap interest rate increases for short periods.[25] Swiss Lombard rates float daily at two percentage points above the average of the previous two days' interbank call money rates. German Lombard rates, in contrast, are fixed by the Bundesbank and in recent years have generally remained no more than 100 basis points above the repurchase agreement rate.

Lombard lending by the Bundesbank has soared for brief periods on several occasions in recent years. These surges in lending reflect, in addition to market-related liquidity developments, a strategy for tightening policy: money market rates are increased first; once market pressures build, these increases are validated in official rates.[26]

In the other countries reviewed, the central bank has greater freedom to decide the terms on which lending is made available. In the United States, the Federal Reserve generally sets the discount rate below short-term market rates and rations access through administrative guidelines. Lending is designed to provide for unexpected liquidity needs, particularly at the end of reserve maintenance periods. For institutions that use the window frequently, however, future access is reduced, raising the implicit cost of borrowing. Furthermore, worries about potential adverse market reactions to discount window borrowing have developed in recent years as bank failures and earnings stress have risen. The use of the discount window has, consequently, been relatively limited.

Of the countries under review, only Japan makes lending an important instrument in short-term reserve management. Discount window lending makes up a substantial share of BOJ assets (currently over 10 percent), and the Bank actively manages its lending policies on a daily basis. The BOJ can either increase or call discount window loans at its discretion, and typically uses this instrument to smooth daily fluctuations in bank reserve positions. In addition, with its "plus-one-day" pricing of loans, the BOJ's effective lending rate exceeds the discount rate and can become penal for very short-term loans.[27] Discount window lending thus gives the BOJ a highly flexible instrument for influencing daily conditions in interbank markets.

England's central bank also has discretion in providing credit. In its transactions with discount houses the BOE can decide whether to provide credit and what the price of that credit will be. Funds are made available for "late assistance" to meet interbank clearing needs, but the terms of this borrowing are determined by the BOE and are not disclosed publicly. Generally funds are lent at or above market rates, in a way that permits the discount house to predict the cost accurately. As noted earlier, the BOE occasionally uses its lending policies to signal changes in its policy stance, allowing discount houses to borrow at a publicly announced rate after it has refrained from accommodating reserve demand earlier in the day.

The central bank lending rate of the BOC (the Bank Rate) is adjusted weekly and set ¼ percentage point above the previous Thursday's three-month Treasury bill tender. Until recently, banks were guaranteed recourse to this facility only once during a reserve maintenance period. The cost and availability of further borrowing were subject to the discretion of the BOC. Funds were provided, but at a rising cost for repeated use.

These restrictions on access to BOC credit were removed in November 1991. Banks can now borrow freely at the Bank Rate to cover overnight overdrafts or reserve deficiencies, a change seen as a necessary prelude to the phased elimination of reserve requirements that began in June 1992.[28]

In addition to providing credit to meet short-term liquidity needs, most countries also offer a facility to absorb excess reserves so that short-term downward pressures on interest rates will be limited. In Japan, the BOJ has the option of withdrawing outstanding loans at will during banking hours. The Bundesbank's Treasury bill selling rate functions as an effective floor on call money rates in Germany, and in Canada, matched or outright sales of Treasury bills serve a similar purpose. In the United Kingdom, discount houses can offer to

[25]Both central banks impose quotas on access to Lombard facilities, but the quotas rarely impose an effective constraint on borrowing.

[26]The maturity of Lombard loans is determined by the remaining maturity of securities rediscounted. Generally the Bundesbank grants such loans with the expectation that borrowing should be repaid the following day. Nonetheless, there exists some incentive to borrow heavily through Lombard loans when repurchase interest rates are expected to increase above Lombard rates at the subsequent weekly repurchase agreement tender.

[27]The interest charged on discount window loans is calculated on the period of the loan (using the official discount rate) plus one day. Thus, the effective rate of interest rises as the BOJ reduces the length of time for which it is willing to lend.

[28]Under the regulations in place since June 1992, a bank with a cumulative deficiency at the end of a reserve maintenance period may pay a fee, charged at the Bank Rate, in lieu of taking an end-of-period advance. In practice, banks have adopted the fee option, so that end-of-period advances no longer appear on the BOC balance sheet.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

purchase securities from the BOE in the afternoon if surpluses emerge.

Reserve requirements

Like central bank lending, required reserve ratios have diminished sharply in recent years. Required reserve ratios in all these countries stand well below their levels of the early 1980s; in some countries, requirements no longer effectively constrain bank behavior. In addition, the once common practice of altering reserve requirements to adjust the monetary policy stance has largely been discontinued.

Nonetheless, most central banks still view reserve requirements as an important part of their implementation procedures. Requirements are seen as strengthening and stabilizing the short-run demand for reserves, thus enhancing central bank control over interest rates. A summary of important characteristics of reserve requirement regulations is presented in Table 5.

Required reserves in all six countries examined are determined by ratios linked to categories of bank liabilities.[29] In the United States and, until recently, in Canada, requirements have primarily been imposed on transactions deposits, a practice that reflects earlier attempts to use reserve requirements to facilitate the targeting of M1 through operating objectives for bank reserves. Elsewhere, requirements are more broadly based. In the United Kingdom, Japan, and Switzerland, requirements are roughly similar across types of eligible liabilities.

In all these countries, the period in which liabilities are incurred (the accounting period) ends before the period in which required reserves are held (the maintenance period). These lagged or semilagged accounting mechanisms are operationally convenient and, where reserve requirements are binding, provide central banks with a relatively good estimate of reserve demand within a maintenance period. For all six central banks except the BOE, reserve projections at maintenance period horizons are a key element in determining policy operations.[30]

Although lagged reserve requirements predetermine the demand for reserves, they can also severely limit the interest sensitivity of reserve demand, particularly at the end of maintenance periods. Unforeseen shifts in either the demand for or the supply of reserves have often led to large fluctuations in overnight rates at the end of a maintenance period. To provide greater flexibility in reserve management, particularly in the early

[29] In June 1992, Canada removed required reserve ratios as part of its phased elimination of reserve requirements.

[30] As noted earlier, clearing banks in the United Kingdom provide the BOE with an estimate of the operational balances they wish to hold each day. The BOE uses these estimates as a guide in determining daily security operations.

Table 5

Reserve Requirement Regulations

	United States	Japan	Germany	United Kingdom	Canada†	Switzerland
Length of reserve accounting period	14 days	1 month	1 month	6 months	1 month	3 months
Length of maintenance period	14 days	1 month	1 month	6 months	15 days	1 month
Interval from end of accounting period to end of maintenance period	2 days	15 days	15 days	180 days	30/45 days	50 days
Highest reserve ratio for demand deposits	10	1.3	12.1	0.5	10	2.5‡
Highest reserve ratio for other deposits	0	1.2	4.95	0.5	3	0.5
Averaging provisions	Yes	Yes	Yes	No	Yes	Yes
Carryover provisions	Yes	No	No	No	No	No
Vault cash satisfies requirement	Yes	No	Up to 50 percent	No	Yes	Yes
Penalty for reserve deficiency (percentage above central bank lending rate)	2	3-5	3	0	0	0
Interest paid on reserves	No	No	No	No	No	No

†As of June 1992, reserve ratios were eliminated in Canada as part of a planned phaseout of required reserves. Currently, required reserves are set at a fixed level for each bank; these levels will decline to zero in 1994. The maintenance period has been extended to one month. Banks incurring a reserve deficiency pay a penalty calculated at the Bank Rate.

‡Includes time deposits with a term to maturity of up to three months.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

stages of a maintenance period, nearly all of these central banks allow required reserves to be met by average reserve holdings over a maintenance period.[31] Reserve averaging gives value to banks' excess reserve positions by enabling the banks to maintain offsetting deficiencies during other days within the period. As a result, banks have an incentive to arbitrage away the interest rate effects of temporary reserve shocks. Through this mechanism, required deposits at the central bank can function as an important aid to central banks in promoting interest rate stability.[32]

The extent to which bank reserves actually serve as a buffer stock is related to the level of reserve balances held at the central bank. Because overnight overdrafts are restricted in Switzerland, Japan, and Germany, and penalized in the United States, Canada, and the United Kingdom, the cost of running reserve deficiencies rises substantially when average reserve balances are low. In the United States and Canada particularly, concerns have arisen about the banking system's reduced ability to absorb reserve imbalances at low reserve levels. Reserve deposits held at the central banks of both countries have fallen sharply in recent years as a result of a secular increase in demand for vault cash to satisfy reserve requirements and, in the United States, a reduction in reserve requirements (Table 6).[33]

[31]Reserve averaging extends over one month in Germany, Japan, and Switzerland, and over two weeks in the United States. In Canada, reserve averaging extended over two half-month periods until June 1992, when it was extended to one month.

[32]A provision for the carryover of a portion of reserve surpluses (or shortages) allows for some additional flexibility in managing reserves across maintenance periods in the United States.

[33]In both countries, holdings of vault cash over previous maintenance periods satisfy current reserve requirements. Increased demand for vault cash thus lowers required deposits even when reserve requirements are unchanged.

Table 6

Reserve Deposits Held at Central Banks as a Share of Total Bank Liabilities

(Year Average of End-Month Observations, in Percent)

	1980	1985	1988	1991
United States	1.6	0.8	1.0	0.6
Japan	1.6	1.1	1.0	1.0
Germany	7.2	5.6	5.5	5.5
Switzerland	4.0	3.1	1.7	0.7
United Kingdom	0.3†	0.1	0.1	0.1
Canada	3.9	1.4	0.8	0.4

†Figure is for year-end 1981.

Reserve management strategy in the United States traditionally focused on the two-week average reserve levels held by banks over a maintenance period. Since the cut in reserve requirements in December 1990, however, the open market desk has experienced increasing conflict between this strategy and daily federal funds market conditions. Many banks have become less tolerant of excess reserve positions early in the maintenance period, a reaction that has often led to significant late-day downward pressure in federal funds rates. At the same time, the funds rate in the morning can be a misleading guide to reserve market conditions because banks sometimes hold on to reserves early in the day to guard against inadvertent overdrafts. When faced with these conflicts in conducting its operations, the Desk has chosen to pay greater attention to daily trading conditions in the federal funds markets to prevent misleading signals from being sent to markets.[34]

In two countries, the United Kingdom and Switzerland, reserve requirements place no effective constraint on bank behavior. In the United Kingdom, banks must place small nonliquid deposits at the Bank of England for six months at a time. This requirement provides the BOE with operating income but is not intended to play a role in the BOE's monetary policy operating strategy.

Since effective requirements are lacking, demand for reserves (operational deposits) is determined entirely by daily clearing needs. In this environment, the BOE has developed an operating strategy involving a number of daily market operations to respond to interest fluctuations and other intraday developments. In addition, banks' uncertainty over their end-of-day clearing needs is eased by the availability of BOE late-day lending facilities to discount houses. BOE policies stabilize reserve demand and encourage banks to economize on reserve holdings (Table 6).

Since the decline in reserve requirements in Switzerland in 1988, the SNB has placed greater emphasis on smoothing daily fluctuations in interest rates through its daily activities. In addition, central bank lending facilities in the form of Lombard loans are available to banks without restriction to meet unexpected liquidity shortfalls. Nonetheless, the SNB is much less accommodative than other central banks in its approach to offsetting temporary reserve disturbances, prohibiting overnight overdrafts and setting a large spread (200 basis points) between market and Lombard lending rates. In this environment, Swiss banks have chosen to hold substantial reserve deposits in excess of those required by regulations.

[34]See "Monetary Policy and Open Market Operations during 1991" for further details.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Relevance for U.S. monetary policy operations

The varied institutional and political environments facing these central banks make it difficult to assess whether practices followed in any one country would be useful to another. Nonetheless, the comparison of operating procedures presented above does provide interesting insights, some of which may be relevant to U.S. policy makers.

The similarities in operating strategy among these central banks dominate any existing differences. All six banks currently gear their daily policies toward influencing money market interest rates; all except the SNB use short-term interest rates as operating objectives to guide their reserve management activities.

Furthermore, none of the banks employing interest rate objectives aims to control interest rates rigidly. Although the tolerance for interest rate divergences from objectives differs across banks, authorities generally allow market forces to determine interest rates and intervene only to limit short-term fluctuations or to alter rates when changing economic conditions warrant.

Since interest rate operating objectives are transmitted to economic activity largely through their linkage to longer term interest rates and other financial prices, central bank intervention strategies are designed to communicate information about current and future policy that strengthens this transmission. In most cases, interest rate objectives are changed in small steps to stabilize expectations across the term structure. In some countries, central banks intervene in assets of varying maturities to influence the money market term structure directly.

In addition, these central banks actively seek to limit the daily volatility of targeted interest rates in order to reduce uncertainty about the stance of policy. In some countries (Germany, the United Kingdom) intervention rates under the tight control of the central bank send a precise signal of central bank intentions. Elsewhere, although some interpretation of money market interest rate movements is necessary, the central banks stabilize their targeted rates sufficiently so that the basic thrust of their policies is clear.

Over the past decade, foreign central banks have increased the role of open market operations as a reserve management instrument, moving toward an approach long followed by the Federal Reserve in the United States. At present, each of the central banks reviewed employs some form of open market operation as an instrument for controlling reserves. Some foreign central banks conduct their operations through special arrangements with banks or other counterparties. But where these arrangements exist, they generally reflect the limited development of secondary security markets.

More meaningful differences among the six central banks emerge in the functioning of their credit facilities. To be sure, the monetary authorities in all six countries extend credit to banks with temporary clearing imbalances and to banks in financial stress. But the foreign central banks differ from the Federal Reserve in their tendency to eliminate administrative controls on credit allocation.

In three countries—Germany, Switzerland, and Canada—banks are able to access an open-ended line of credit for temporary liquidity needs at their discretion. Borrowing rates are set above the prevailing market rates and, in Switzerland and Canada, rates adjust automatically to market rates. In Japan and the United Kingdom, access to the discount window remains at the discretion of the central bank. In practice, however, discount houses in the United Kingdom can count on the central bank to meet temporary liquidity needs at rates close to the Bank of England's prevailing intervention rates.

These facilities provide foreign central banks with a flexible instrument to contain interest rate pressures, particularly late in a trading day when other intervention instruments are unavailable. In addition, each of these foreign central banks offers a facility to absorb late-day reserve excesses and thereby moderate downward interest rate pressures.

The Federal Reserve's discount mechanism has considerably less value as a device for smoothing interest rates. U.S. discount window lending is provided at subsidized rates and in accordance with administrative discretion. Partly because of this subsidy, the Fed discourages frequent use of the window. In recent years, banks have shied away from approaching the window, fearing that the markets will perceive them to be dependent on discount window support. The unwillingness of banks to borrow at the discount window also reduces the ability of banks to shed excess reserves through their repayment of outstanding credit.

In an environment of high, binding reserve requirements, the methods employed by central banks to allocate credit might not significantly affect their ability to limit interest rate variability. With sufficient averaging provisions in place, banks can be expected to arbitrage away the interest rate effects of transitory shocks to their reserve positions within a maintenance period. Indeed, recourse to Lombard loans in Germany, the country that has the highest reserve requirements and longest maintenance period of the six countries considered, is quite small under normal market conditions.[35]

[35]The Bundesbank estimates normal Lombard lending at DM 0.5 billion, a level representing less than 0.2 percent of total central bank assets. As noted earlier, Lombard lending has risen sharply during short periods in which the Bundesbank allows repurchase agreement rates to push up against Lombard rates before it tightens policy.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Box: Overnight Interest Rate Variability

The review of central bank operating procedures presented in the text suggests that foreign central banks, in contrast to the Federal Reserve, employ their reserve management instruments, particularly lending facilities, in a way that places strict limits on overnight interest rate variability. In assessing the relevance of such facilities for the Federal Reserve, it is useful to compare the variability of interest rates in the United States and the five other countries considered.

Table A1 presents two measures of overnight interest rate variability for the 1988-91 period. The first computes the average absolute deviation of overnight rates around a thirty-day centered moving average. The second measures the average absolute deviation of overnight rates around a mean adjusted for changes in policy stance. This second measure is constructed by identifying dates on which each central bank's interest rate operating objectives changed.† The mean level of overnight rates under a particular policy objective is used to represent a central bank's policy stance, and variability is computed around this changing mean.

In principle, this measure should provide a more accurate indication of how interest rates diverge from a central bank's objective. However, changes in policy stance cannot be identified precisely. Moreover, although most central banks try to smooth overnight rates, significant differences in the degree of their tolerance for overnight rate volatility are not accounted for in this analysis.

The two measures of interest rate variability present a very similar picture. Despite the limited instruments available to the Federal Reserve to offset late-day reserve market imbalances, a comparison with other countries indicates that U.S. overnight interest rate variability is relatively low. The federal funds rate has diverged, on average, about 14 basis points daily from mean levels over 1988-91, a deviation less than that in any other country except Japan. Note, however, that these measures do not indicate the degree of intraday interest rate variability, an issue of some concern to U.S. policy makers.

The evidence also points to a relationship between required reserves and overnight interest rate variability. In the United Kingdom and Switzerland, the two countries operating with low, nonbinding reserve requirements, overnight rates are much more volatile than the

†For the United States, dates on which the expected trading range for the federal funds rate changed were obtained from the Open Market Desk of the New York Federal Reserve Bank. Figures for 1990 and 1991 appear in "Monetary Policy Operations during 1991," this *Quarterly Review*, Spring 1992; and "Monetary Policy Operations during 1990," this *Quarterly Review*, Spring 1991. For countries with well-defined intervention rates that signal the monetary policy stance—Canada, the United Kingdom, and Germany—movements in these rates were used to identify policy changes.

† *continued*
For Japan, discrete changes in the overnight call rate were inferred from the actual movements in rates. Since the SNB does not employ interest rate operating objectives, this measure of rate variability was not computed for Switzerland.

Table A1

Overnight Interest Rate Variability

(Mean Absolute Deviation of Daily Observations, in Basis Points)

	Deviations from Thirty-Day Centered Moving Average					Deviations from Mean Adjusted for Changes in Policy Stance†				
	1988	1989	1990	1991	Average 1988-91	1988	1989	1990	1991	Average 1988-91
United States	12.3	11.9	12.3	21.1	14.4	13.0	11.8	12.8	18.5	14.0
Japan	8.7	8.5	7.1	8.4	8.2	12.5	8.5	7.4	5.8	8.6
Germany	15.7	18.2	13.6	13.4	15.2	15.8	17.4	14.5	14.8	15.6
United Kingdom	50.4	32.9	14.8	25.3	30.9	52.5	39.7	14.2	25.0	32.9
Canada	9.7	13.4	21.3	28.7	18.3	11.0	15.7	21.3	28.8	19.2
Switzerland	—	33.8	34.8	37.8	35.5	—	—	—	—	—

Note: Overnight interest rates are the effective overnight federal funds rate (the United States), overnight call rate (Japan), day-to-day money rate (Germany), London interbank offer rate (the United Kingdom), overnight money market financing rate (Canada), and overnight call rate (Switzerland).

†Values are average absolute deviations of overnight rates from a mean that changes with estimated shifts in central bank interest rate operating objectives.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table A2

The Transmission of Overnight Rate Variability to the Variability of Three-Month Money Market Rates

(Based on Monthly Observations, 1988-91)

$MAD^M_t = C + B\ MAD^O_t + \mu_t$

	C	B	$\bar{R}^2$	DW
United States	0.12	−0.16	−0.01	2.23
	(4.79)	(−0.95)		
Japan	0.04	0.22	−0.01	2.34
	(0.90)	(0.41)		
Germany	0.05	0.25	−0.02	1.92
	(1.46)	(1.28)		
United Kingdom	0.14	−0.01	−0.01	1.67
	(7.14)	(−.14)		
Canada	0.05	0.04	0.10	1.90
	(3.71)	(0.58)		
Switzerland†	−0.13	0.70*	0.23	2.32
	(−0.79)	(2.07)		

Note: Equation is estimated using instrumental variables. Instruments include lagged MAD^O and lagged levels of interbank interest rates. Overnight interest rates are those described in Table A1. Three-month money market rates are the three-month Treasury bill rate (the United States and Canada), Gensaki rate (Japan), three-month interbank loan rate (Germany, Switzerland) and the three-month Sterling interbank deposit rate (the United Kingdom).

†Sample covers June 1989-December 1991.

*Significant at 5 percent level.

rates elsewhere. In addition, in the United States and Canada, where reserve deposits held at the central bank have fallen in recent years, the decline in reserves has been accompanied by rising interest rate variability.

These findings support the view that central banks face greater difficulty in stabilizing interest rates around desired levels when reserve requirements are eased. Nevertheless, increased overnight interest rate volatility, per se, need not erode the effectiveness of monetary policy, particularly if fluctuations in overnight rates are transitory and do not reduce the ability of market participants to identify the authorities' policy intentions.

To assess whether overnight interest rate variability has influenced the monetary transmission mechanism, one must determine whether the overnight rate variability affects longer term market interest rates. Table A2 presents regression results estimating the effect of overnight rate variability (MAD^O) on the measured volatility of three-month money market rates (MAD^M).‡ As the table shows, overnight rate variability is not systematically related to three-month money market rate divergences in the United States. Indeed, of the countries surveyed, only Switzerland has large and statistically significant coefficient estimates for transmission.

‡In Table A2 the volatility of interbank (MAD^O) and three-month money market rates (MAD^M) is measured as the absolute deviation of rates adjusted for changes in the monetary policy stance. For Switzerland, however, deviations around a thirty-day centered moving average are used. Note that the results are qualitatively unchanged by the choice of variability measure.

Table A3

Interest Rate Variability and the Transmission of Changes in Federal Funds Rate Objectives: 1988-91

$\Delta R_t = C + (B_1 + B_2\ MAD^O_{t-1})\Delta ff_t + \mu_t$

	C	B_1	B_2	$\bar{R}^2$	DW
Response of three-month bill rates (ΔR_t)					
Day of federal funds objective change	−0.02	0.22**	0.06	.51	1.86
	(−1.51)	(4.03)	(0.22)		
Five days following federal funds objective change	−0.38	0.26*	0.58	.40	2.25
	(−1.39)	(2.42)	(1.31)		

*Significant at the 5 percent level
**Significant at the 1 percent level

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Box: Overnight Interest Rate Variability *(Continued)*

Perhaps a more important issue is whether overnight rate variability influences the transmission of changes in central bank operating objectives to money market rates. To resolve this issue in the case of the United States, one can test whether the federal funds rate variability measure affects the response of three-month Treasury bill rates immediately after a change in the Open Market Desk's federal funds rate objective. In the regression

$$\Delta R_t = c + (b1 + b2\ MAD^O_{t-1})\Delta ff_t + \mu_t$$

ΔR_t is the change in the three-month Treasury bill rate; MAD^O_{t-1} is the average absolute deviation of the federal funds rate from the Desk's objective, measured over the preceding objective period; and Δff_t is the change in the Desk's federal funds objective.[§] The coefficient estimate for b2 provides an indication of how variability has affected the transmission of federal funds rate changes.

The regression results are presented in Table A3. Estimates are given for the responsiveness of the three-month Treasury bill rate on both the day of the federal funds rate change and the five-day period following the change. As the table shows, the three-month Treasury bill rate rose on average 22 basis points in response to a percentage point rise in the federal funds rate objective on the day the objective increased. This response increased to 26 basis points after five days. The variability of the federal funds rate does not appear to have altered this response. In both regressions, the coefficient on variability is not significant and enters with the wrong sign. Taken together, the results presented in Tables A2 and A3 suggest that federal funds rate variability, within the range observed, has not altered monetary policy transmission in the United States.

[§]This analysis closely follows earlier work by Timothy Cook and Thomas Khan, "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal Of Monetary Economics*, vol. 24 (1989), pp. 331-51.

But in the United States, recent declines in reserve requirements, coupled with increased demand for vault cash, have sharply reduced reserve deposits at the Federal Reserve. In an environment where overnight overdrafts are costly, the ability of banks to take advantage of reserve averaging has become more limited as reserve deposits decline. These developments, coinciding with the deterioration in the functioning of the discount window, may have increased the sensitivity of the federal funds rate to reserve shocks.

The foreign central banks that have faced similar concerns about the effects of lower reserve requirements have tended to revise their procedures to allow for a more elastic late-day reserve supply. The BOE, operating for over a decade in an environment where banks are effectively free from reserve requirements, has developed a strategy combining the elastic provision of central bank credit for late-day reserve imbalances with frequent open market operations during the trading day. The SNB has placed greater emphasis on interest rate smoothing in daily operations since a reduction in reserve requirements in 1988. In addition, while maintaining a large spread between rates on its Lombard lending and overnight rates, the SNB has increased access to central bank lending facilities since the decline in required reserves. In Canada, restrictions on bank access to BOC credit have also recently been removed as part of the phased elimination of reserve requirements.

The example of other central banks, then, raises a question: Should the Federal Reserve consider revising its operating procedures to adapt to lower reserve requirements? A procedural change that enabled the Federal Reserve to supply reserves more elastically outside of the time it conducts open market operations could conceivably help limit the variability of interest rates from objectives.

To resolve this issue, an assessment of federal funds rate variability and its effect on monetary policy transmission is essential. The accompanying box sheds some light on the issue by presenting evidence on actual interest rate variability. The interday fluctuations of the federal funds rate does appear to have risen following the decline in reserve requirements in 1990. However, U.S. federal funds variability remains low in comparison with the volatility observed in overnight rates in other countries. More important perhaps, the evidence indicates that increased federal funds rate variability, within the range observed, has not diminished the response of three-month money market rates to changes in interest rate objectives. Thus, these results suggest that the reduction in reserve requirements has not weakened the effectiveness of the Federal Reserve's policy transmission mechanism.

Conclusion

Our analysis, while far from conclusive, provides insights that may be useful in assessing monetary policy operating procedures in the United States. Like the Federal Reserve in the United States, several foreign central banks have lowered their reserve requirements in recent years. Their experience indicates that interest-

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

rate-oriented monetary policies can be carried out in an environment of low, nonbinding reserve requirements. Central banks operating in such an environment have been able to achieve their interest rate objectives using reserve management techniques quite similar to those employed by the Federal Reserve System in the United States.

Foreign central banks have, however, seen the need to develop mechanisms that provide a highly elastic supply of reserves to restrict the intraday fluctuation of overnight interest rates. In most countries, the authorities have designed their central bank lending facilities, with rates set at or above current market interest rates, to achieve this goal.

The empirical evidence presented in this article indicates that the recent decline in reserve requirements in the United States, combined with the increased reluctance of banks to approach the discount window, has been associated with greater variability in the federal funds rate. Nevertheless, the evidence also suggests that this rise in variability has not diminished the effectiveness of U.S. monetary policy operating procedures. Within its current range, the variability of the federal funds rate remains low and does not appear to have affected the linkage between federal funds and other money market rates.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Finance Companies, Bank Competition, and Niche Markets

by Eli M. Remolona and Kurt C. Wulfekuhler

During the 1980s, U.S. commercial banks faced increased competition in their lending activity from other financial intermediaries. Large finance companies were an especially vigorous competitor of banks. Because finance companies enjoyed their success despite carrying apparently heavier capital burdens and lacking the advantage of deposit insurance, concerns arose that commercial banks were being hampered by the structure of their regulation and ownership.

This study seeks to explain the differential performance of banks and finance companies in common lending markets. We find that while regulatory and ownership factors were important, they were not the primary determinants of success in individual markets. Had these institutional factors been decisive, finance companies would have outperformed banks in both consumer and business credit markets. But in the consumer credit markets generally, finance companies lost market share to banks and their affiliates. Finance companies fared better than banks overall because they benefited from surging demand in sectors where they were well established and highly experienced, notably in the equipment leasing segment of the middle market for business credit. Even as banks with excess lending capacity became more willing to take risks in commercial real estate and highly leveraged transactions, they mounted little direct challenge to the finance companies in important segments of the middle market.

Why was this so? The evidence shows that much of the growth in the leasing market took place in niches, market segments of relatively risky credit where command of specialized information was critical to lenders. In niches such as commercial aircraft leases and medical equipment leases, finance companies enjoyed dynamic scale economies in information because of their early entry and accumulated experience in the business. Since banks could not develop their own expertise at once, such learning-curve economies served as a substantial barrier to entry.

Nonetheless, the niche barrier was not insurmountable; indeed a few banks did break into the equipment leasing market. Banks could have overcome the niche barrier either by expanding rapidly to accelerate their learning or by acquiring an existing leasing operation. These strategies entail entry costs, however, and banks would have needed a sufficient cost-of-funds advantage to earn the high future returns that would make up for the initial costs. We argue that most large banks lacked this funding advantage and thus chose to bypass good opportunities in the fast-growing leasing markets.

In the following sections, we first analyze the growth of finance companies and the importance of good credit ratings. Then we examine how finance companies took advantage of niches in their traditional markets. Finally, we discuss the factors inhibiting bank entry into the finance companies' leasing niches.

Growth of finance companies

Nature of the industry

Finance companies are a diverse group of nondepository financial institutions. Like commercial banks, these institutions extend credit to both consumers and businesses, although they traditionally concentrate on loans secured by tangible assets.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Large companies have long dominated the finance company industry. In 1990 the combined assets of the twenty largest firms totaled $426 billion, or 82 percent of the industry's overall assets (Table 1). These large companies tend to be wholly owned subsidiaries of nonfinancial firms, and the very largest are most often "captives" that finance principally the sales and leases of their parents. Of the twenty largest finance companies, seven are captives, five are noncaptives owned by nonfinancial parents, three are owned by nonbank financial parents, three are affiliated with banks, and two are independent.

The largest finance companies tend to be those that diversified from consumer credit into business credit. The convention in the literature is to consider a finance company diversified if it holds at least 35 percent of its receivables in the form of commercial and industrial credit; otherwise it is considered a consumer finance company.[1] Of the top twenty, twelve are diversified finance companies, and by 1990 they held over four-fifths of the assets of this group.

Growth and excess capacity

For most of the 1980s, finance companies grew faster than commercial banks (Chart 1). From 1980 to 1990, accounts receivable for the finance company industry grew an average of 11.4 percent a year; in contrast, commercial bank loans grew 8.4 percent a year. Yet finance companies enjoyed equity returns well above those of commercial banks (Chart 2). The banks' poor returns reflected excess lending capacity, specifically their having more resources in the short run than they needed to meet the demand for credit in their traditional markets.[2] We argue below that finance companies faced no such problem: the strong demand for credit in some of their traditional markets allowed them to utilize their resources fully.

Composition of credit growth

Finance companies set themselves apart from commercial banks by sustaining impressive growth in business credit through the second half of the decade. Initially, consumer and business credit contributed fairly evenly to the growth of finance companies, as they did to the growth of commercial banks. The major divergences in growth showed up mainly in the second half of the decade. For finance companies, consumer credit slowed and grew only 4.0 percent a year during this period, while business credit picked up the slack by growing 13.1 percent a year (Chart 3). Much of the business credit growth was in leasing, which grew 17.8

[1]The classification scheme follows that used by the First National Bank of Chicago. The bank's annual review of finance companies appears in the *Journal of Commercial Bank Lending*.

[2]These resources included the services of loan officers and the credit relationships they had developed.

Table 1

The Twenty Largest Finance Companies

Assets in Million of Dollars, End-1990

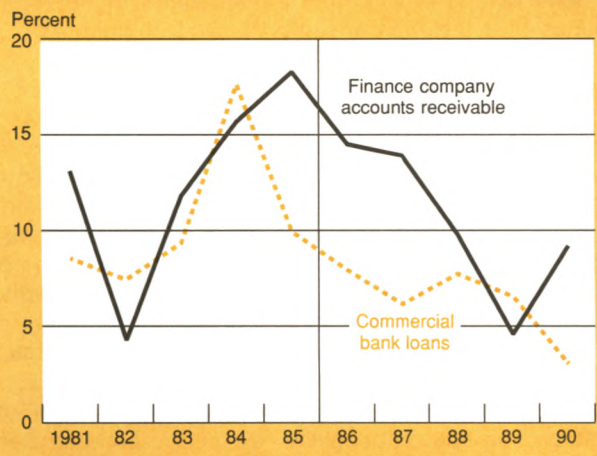
Rank	Assets	Parent Relationship/ Type of Parent	Concentration of Business
1 General Motors Acceptance Corp.	105,103	Captive	Diversified
2 General Electric Capital Corp.	70,385	Nonfinancial firm	Diversified
3 Ford Motor Credit	58,969	Captive	Diversified
4 Chrysler Financial	24,702	Captive	Diversified
5 Household Financial	16,898	Independent	Consumer
6 Associates Corp. of North America	16,595	Nonfinancial firm	Diversified
7 Sears Roebuck Acceptance Corp.	15,373	Captive	Consumer
8 American Express Credit	14,222	Captive	Consumer
9 ITT Financial Corp.	11,665	Nonfinancial firm	Diversified
10 CIT Group	11,374	Bank holding company	Diversified
11 I.B.M. Credit	11,132	Captive	Diversified
12 Westinghouse Credit	10,336	Nonfinancial firm	Diversified
13 Security Pacific Financial Services System	9,928	Bank holding company	Diversified
14 Beneficial Corp.	9,270	Independent	Consumer
15 Transamerica Finance	8,501	Financial nonbank	Diversified
16 Heller Financial	7,512	Bank holding company	Diversified
17 Commercial Credit Corp.	7,138	Financial nonbank	Consumer
18 American General Finance	5,933	Financial nonbank	Consumer
19 Toyota Motor Credit	5,579	Captive	Consumer
20 Avco Financial	5,084	Nonfinancial firm	Consumer

Sources: *American Banker*, December 11, 1991; First National Bank of Chicago; annual reports.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

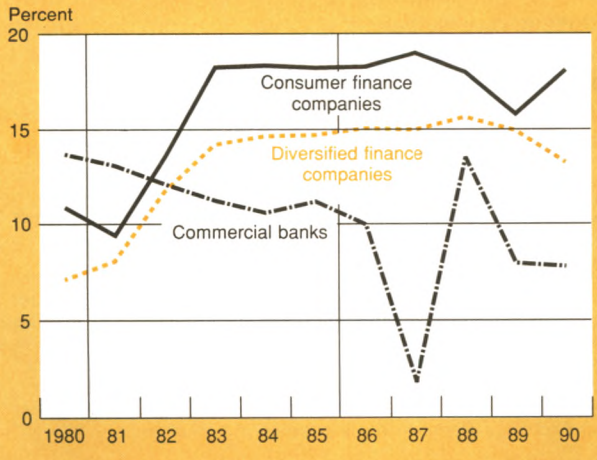
percent a year during the period. Banks and finance companies had opposite patterns of consumer and business credit growth: individual loans by banks still grew 5.1 percent a year, while their commercial and industrial loans grew barely 2.8 percent a year.[3] Thus, while finance company receivables altogether rose nearly 10.4 percent a year from 1985 to 1990, commercial bank loans increased only 6.3 percent a year.

Chart 1
Asset Growth Rates



Source: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin.*

Chart 2
Return on Equity



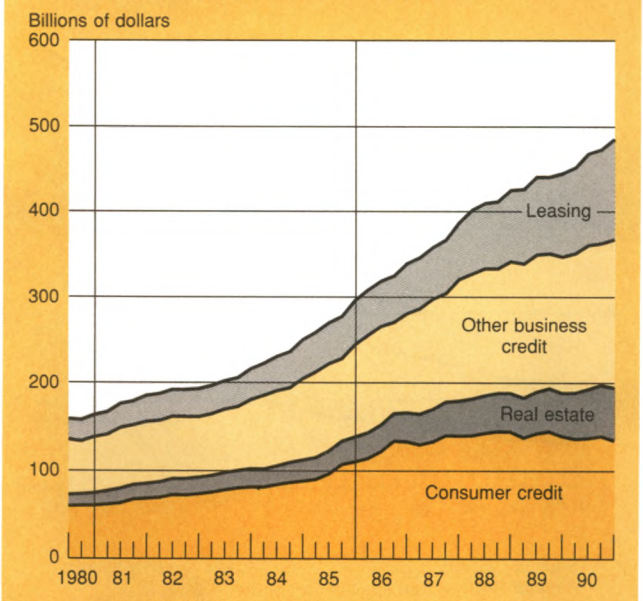
Sources: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*; First National Bank of Chicago.

Liabilities growth

The growth of finance company assets was financed largely with funds from the burgeoning securities markets (Chart 4). Unable to issue deposits, finance companies raised funds largely in the commercial paper (CP) and corporate bond markets. At first, the CP market was the primary source of funds, with money market mutual funds allocating major portions of their portfolios to highly rated commercial paper. Finance companies became by far the largest issuers in the CP market. The outstanding amount of CP by finance companies grew an average of 12 percent a year from 1980 to 1990 and stood at $153 billion by the end of the period. In the second half of the decade, total liabilities grew more slowly, but corporate bond issuance surged 14 percent a year and assumed considerable importance as a

[3]Although real estate lending escalated throughout the decade for both commercial banks and finance companies, it grew from a small base and, in the case of finance companies, still represented only 12 percent of receivables at the end of 1990.

Chart 3
Finance Company Gross Receivables



Source: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin.*

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

source of funds. By 1990, long-term debt, at $184 billion, had become the largest component of finance company liabilities. A significant part of this debt took the form of subordinated debt from parents.

Importance of credit ratings

The finance companies' reliance on securities markets for financing made credit ratings a key determinant of their growth. Table 2 reports credit ratings for large finance companies' senior debt and CP in 1985 and 1990. The table divides the companies into the fast growing (those that exceeded the industry growth average) and the slow growing, and ranks the individual companies by growth rates within each category. The table shows that fast-growing companies had generally better credit ratings than did the slow-growing companies.

A more systematic statistical analysis confirms the importance of credit ratings. Using data from 1985 to 1990, Table 3 reports econometric estimates of the effect of senior debt ratings on asset growth when the effects of capital ratios, parent relationships, and demand conditions are taken into account. Year dummies proxy for demand conditions. Credit standings are represented by bond ratings because these are not as tightly clustered as the CP ratings.[4] The regression shows that of the supply-side variables, only the finance company's own credit rating significantly explains asset growth.

In the 1980s, a prime credit rating afforded easy access to low-cost funds from the securities markets.[5] It was evidently the ticket to expanding in the business credit market, which required tighter lending margins than did the consumer credit market. Indeed, the diversified finance companies generally maintained higher credit ratings than did the consumer finance companies.

Importance of parents

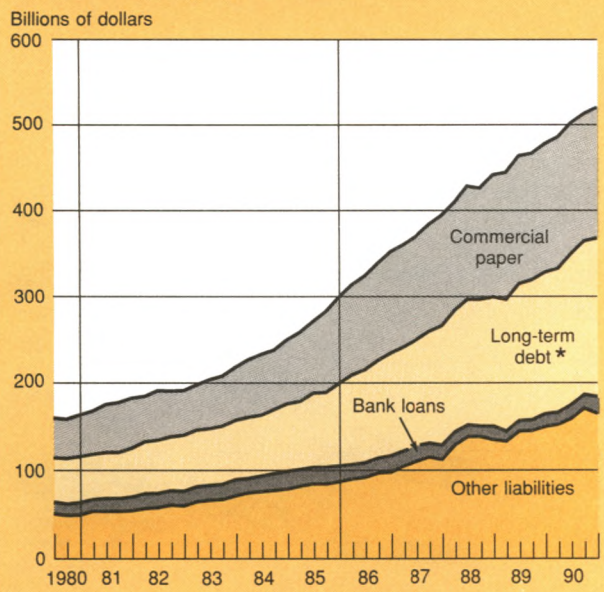
A finance company's credit rating depends not so much on its own capitalization as on the existence of a parent and the perceived capital strength of that parent. Some of the strongest parents are commercial or industrial firms. Financial ties to such parents often help raise a finance company's credit ratings and thus lower its borrowing costs, a benefit of ownership that is not institutionally available to commercial banks.

Chart 5 plots credit ratings against stand-alone book capitalization for a number of large finance companies, distinguishing companies with well-rated parents from the others.[6] The apparent negative relationship between credit ratings and capital ratios is striking. At the same time, the chart shows that the companies with strong parents had better credit ratings in spite of lower stand-alone ratios.

Econometric analysis confirms the central role of parents in finance companies' credit ratings. Table 4 presents estimates of the effect of capital ratios, asset size, parent relationships, and parents' senior debt ratings on a company's senior debt rating. When the parents' ratings are left out, asset size is the only significant variable. This finding may suggest that size leads to risk-reducing diversification or that size proxies for such unobservable factors as efficient management. For the companies with parents, however, the parent's credit rating is clearly the dominant factor explaining a subsidiary's rating.

Chart 4

Finance Company Liabilities



Sources: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin* and Flow of Funds data.

* *Federal Reserve Bulletin* data for long-term debt end in 1987. Data after 1987 are based on Flow of Funds data for corporate bonds.

[4]To estimate the regression, the bond ratings are assigned numerical values ranging from a value of 1 for AAA to a value of 10 for BBB–.

[5]A good credit rating is important to finance companies not simply because it keeps the explicit cost of funds low but also because it eases access to the securities market for large debt issues. The average rate for A2/P2 paper from 1980 to 1990, for example, was only 31 basis points more than for A1/P1 paper. More important, money market mutual funds shunned paper that was less than prime; under tight restrictions recently imposed by the Securities and Exchange Commission, this practice has become a rule.

[6]Capital is measured to include both equity and subordinated debt. Some studies include only equity when comparing the capital ratios of financial institutions. See, for example, U.S. Department of the Treasury, "Modernizing the Financial System: Recommendations for Safer, More Competitive Banks," February 1991, chap. 2, Table 1.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table 2

Finance Company Credit Ratings and Growth

	1985 Credit Ratings		1990 Credit Ratings		1985-90 Growth Rate
	Senior Debt	Commercial Paper	Senior Debt	Commercial Paper	
Fast-growing companies					
Toyota Motor Credit	AAA	A-1+	AAA	A-1+	69.5
Transamerica Finance	A+	A-1	A+	A-1	31.0
General Electric Capital Corp.	AAA	A-1+	AAA	A-1+	25.6
Security Pacific Financial Services	N.A.	N.A.	N.A.	N.A.	19.9
American General Finance	A+	A-1+	A+	A-1+	18.7
Heller Financial	A+	A-1+	A+	A-1+	17.8
I.B.M. Credit	AAA	A-1+	AAA	A-1+	17.3
Associates Corp.	AA−	A-1+	AA−	A-1+	16.6
American Express Credit	AA	A-1+	AA	A-1+	16.2
Westinghouse Credit	A+	A-1	A	A-1	15.6
Ford Motor Credit	A	A-1	AA−	A-1+	13.5
ITT Financial Corp.	A+	A-1	A	A-1	13.2
Household Financial	AA−	A-1+	A+	A-1	13.2
Slow-growing companies					
Chrysler Financial	BBB	A-2	BBB−	A-3	9.3
Sears Roebuck Acceptance Corp.	AA−	A-1+	N.A.	A-1	9.2
CIT Group	AA	A-1+	A+	A-1	7.3
General Motors Acceptance Corp.	AA+	A-1+	AA−	A-1+	6.9
Commercial Credit	BBB+	A-2	A+	A-1+	2.4
Beneficial Corp	A	A-1	A	A-1	1.3
Avco Financial	A	A-1	A	A-1	−3.2

Source: Standard and Poor's Corporation, *Commercial Paper Guide*.

Table 3

Asset Growth of Finance Companies

(Dependent Variable Is Growth Rate of Assets in a Year)

	Coefficient	
Constant	8.193	(0.767)
Capital ratio (lagged)	−0.001	(−1.014)
Senior debt rating (lagged)	−1.963	(−2.885**)
1986 Dummy	1.539	(0.266)
1987 Dummy	12.669	(2.202**)
1988 Dummy	10.390	(1.847*)
1989 Dummy	5.011	(0.893)
Dummy for captives	10.522	(1.091)
Dummy for noncaptives with parents	12.116	(1.307)
R-squared	0.144	
Adjusted R-squared	0.083	
Sample size	122	
F-statistic	2.372	

Note: T-statistics are in parentheses.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

By assigning the credit ratings, the rating agencies in effect set capital adequacy guidelines for finance companies. In these guidelines, the agencies take important account of the parents' strength and the financial ties between parents and subsidiaries. When the parent is rated higher than the finance company, rating agencies consider the capital support the parent has provided in the past and its capacity for future support. When the finance company is rated higher than the parent, rating agencies look for mechanisms that protect the subsidiary in the event of parent stress. These mechanisms may include attorney's letters and debt covenants limiting the capital a parent may take out of a subsidiary. On average, a subsidiary receives a somewhat higher rating than its parent because the financial ties are designed to enhance the finance company's rating rather than its parent's.

Niche markets of finance companies

Finance companies of all sizes focus their business strategy on "niches," market segments in which the companies claim special expertise.[7] These niches tend

[7]One of the biggest companies, for example, states, "GE Financial Services has been built on the premise that highly focused, individually led, niche businesses enable us to penetrate specific markets quickly, efficiently, and profitably. Thus, the 22 businesses that make up GEFS are discrete organizations staffed by employees who are experts in their market" (GE Financial Services, *1990 Annual Report*, p. 1) In our interviews with senior officials of several large finance companies, the importance of niche markets was repeatedly emphasized.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

to be segments of the consumer credit market and the middle market for business credit. In the consumer credit market in the 1980s, banks and their affiliates gained market share at the expense of finance companies. In the middle market, banks kept their dominance in lending against accounts receivable, while finance companies held sway over the leasing markets.

The niche strategy meant that, for the most part, finance companies avoided head-to-head competition with banks; instead, the finance companies found their own special segments within markets, competing only by offering services that were imperfect substitutes for bank credit. Some finance companies may have found niches by lending to buyers of their parents' products, others by locating market segments barred to banks by regulatory restrictions.

Dynamic economies of scale

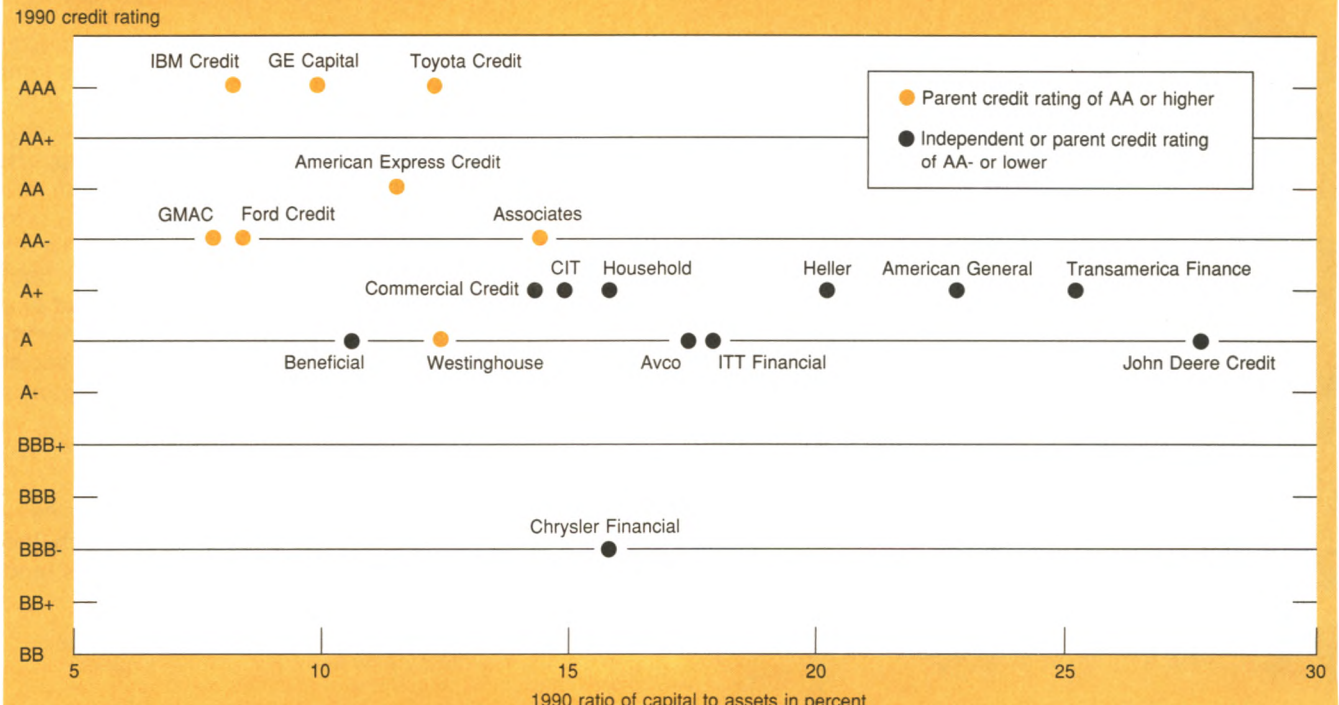
In the credit market niches favored by finance companies, credit risks make specialized information critically important. This special information is acquired through practical experience in the market segment—a form of learning-by-doing. Thus a new lender will face risks greater than those confronting lenders already established in the niche. Such dynamic economies of scale in information cause unit costs to decline with *cumulative* output, unlike static economies of scale, which cause unit costs to fall with *current* output levels. The unit cost curve of a financial service in a niche market is represented in Chart 6. The cost curve is intended to incorporate expected loan losses, operating expenses, and an assumed constant cost of funds. In providing credit services, the lender reduces its noninterest expenses as it learns more about the market, borrower characteristics, and ways to control credit risk.

Structure of income and expenses

The income and expenses of finance companies form a structure that appears consistent with an emphasis on niche markets. Table 5 compares the structure of income and expenses for large finance companies and

Chart 5

Credit Ratings and Capital Ratios



Sources: *American Banker*; Standard and Poor's Corporation.

Note: Capital includes equity and subordinated debt.

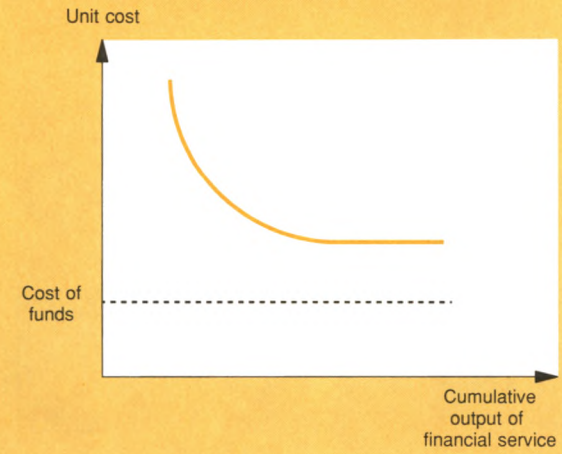
Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table 4
Factors Affecting Credit Ratings of Finance Companies
(Dependent Variable Is Rating of Senior Debt)

	All Companies		Companies with Parents	
Constant	5.518	(4.550**)	1.723	(5.273**)
Capital ratio (lagged)	0.039	(1.704)	−0.012	(−1.051)
Asset size (lagged)	−0.493	(−3.964**)	−0.130	(−2.877**)
Dummy for captives	1.460	(1.141)		
Dummy for noncaptives with parents	−0.522	(−0.430)		
Rating of captive's parent			0.809	(18.490**)
Rating of noncaptive's parent			0.580	(14.484**)
R-squared	0.260		0.826	
Adjusted R-squared	0.235		0.818	
Sample size	125		92	
F-statistic	10.517		103.258	

Note: T-statistics are in parentheses.
* Significant at the 10 percent level.
** Significant at the 5 percent level.

Chart 6
Unit Cost of Financial Service with Dynamic Economies of Scale



insured commercial banks.[8] Average interest expenses are a smaller fraction of assets for banks than for finance companies because banks can issue low-rate insured deposits. Nonetheless, finance companies earn higher spreads by charging their borrowers higher interest rates. Their higher lending rates reflect the greater risks in their niche markets as compared with the credit markets served by banks. In addition, dynamic economies of scale in information allow the finance companies to control their losses and keep their noninterest expenses nearly as low as banks'. As a result, finance companies are able to earn higher returns than banks earn.

[8]The comparison should be treated with caution because it sets only nine large finance companies against all insured commercial banks. A similar comparison by Richard Mead and Kathleen O'Neil uses data for 1980-84. See "The Performance of Banks' Competitors," *Recent Trends in Commercial Bank Profitability: A Staff Study*, Federal Reserve Bank of New York, September 1986, pp. 269-366.

Consumer installment credit

As consumer installment credit grew in the 1980s, finance companies lost market share to banks. In this market, banks may have found an edge in the ordinary economies of scale achieved through data processing technologies and may then have built on that edge in the course of the decade. By the second half of the decade, consumer installment credit extended by banks was growing 7.2 percent a year, while that extended by finance companies was growing 4.2 percent. The finance companies' share of the market fell from 34 percent to 28 percent (Chart 7).

In the auto loan market, the finance company captives of domestic auto manufacturers used subsidized incentives to increase their market share in the middle years of the decade, but subsequent declines in the

Table 5
Analysis of Income for Finance Companies and Banks, 1988-90 Average
Percent of Assets

	Finance Company Sample	All Insured Commercial Banks
Interest revenues	11.36	9.48
Interest expenses	7.21	5.99
Interest spread	4.15	3.49
Other revenues	2.12	1.57
Other expenses	4.54	4.18
Income before taxes and extraordinary items	1.72	0.88
Income taxes and extraordinary items	0.55	0.27
Net income	1.17	0.62

Sources: Annual reports for finance companies; "Recent Developments Affecting the Profitability and Practices of Commercial Banks," *Federal Reserve Bulletin*, July 1991, p. 507.

Note: The finance company sample comprises American Express Credit, Associates Corp., Chrysler Financial, CIT Group, Ford Motor Credit, General Motors Acceptance Corp., Household Finance, ITT Financial Corp., and Sears Roebuck Acceptance Corp.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

sales of the parents allowed banks to get their share back quickly.

Secular trends are clearer in the nonauto consumer credit market. Whatever niche advantage finance companies may have had in personal cash loans was overwhelmed by the advantages banks realized from the development of credit-card technologies, including large-scale credit information services and servicing systems for huge numbers of small accounts.[9] Banks' experience in servicing retail deposits may have given them a better appreciation of the new technology, so that they were quicker than finance companies to offer card-based revolving credit. The technology allowed the extension of credit to be linked to purchases of a wide range of goods and services, an arrangement customers evidently found more convenient than the traditional personal loans from finance companies.

Factoring

Factoring is the business of making loans against accounts receivable, the financing arrangement most widely used in the apparel and textile industries. In practice, the factor purchases a client's accounts receivable without recourse, thus assuming all credit risks as well as collection and bookkeeping responsibilities.[10] This arrangement differs from ordinary accounts receivable financing, in which the client merely pledges its accounts receivable as collateral for a loan.

Bank-related factors have long dominated the factoring industry. Table 6 shows factoring volume in 1985 and 1990 for the fifteen largest factors. Bank-related factors accounted for 94 percent of the total volume in both years. Although volume for the non-bank-related factors grew faster than volume for the bank-related factors, the banks maintained their dominance of the business. Note that a growth rate of 8.4 percent a year in bank-related factoring is impressive compared with the 2.8 percent growth in commercial and industrial lending by banks in the same period.

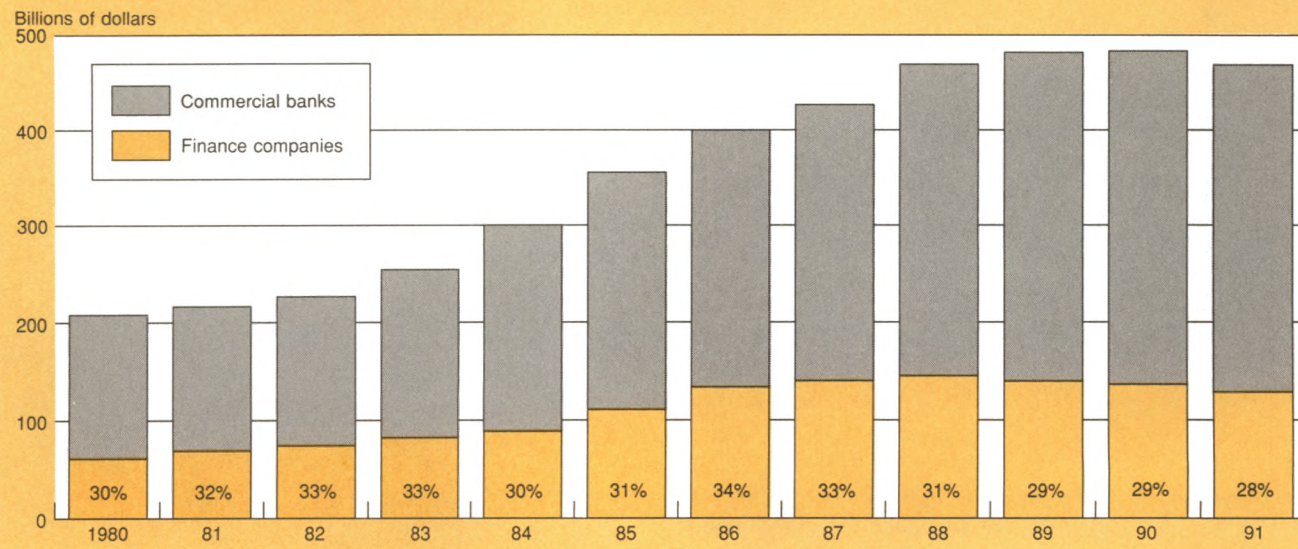
A probable reason for the banks' success in factoring is that the credit review process for the business is similar to that for other forms of revolving credit extended by banks. Factoring, unlike certain forms of lease financing, does not give the creditor clear posses-

[9]See Sangkyun Park, "The Credit Card Industry: Profitability and Efficiency," Federal Reserve Bank of New York, May 1992, unpublished paper.

[10]See Charles Rumble, "Factoring by Commercial Banks," *Journal of Commercial Bank Lending*, February 1969, pp. 2-5.

Chart 7

Consumer Installment Credit



Source: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin*.

Note: Percentages appearing in the bars indicate finance company share of total consumer installment credit extended by banks and finance companies.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

sion of an asset, but banks have found effective ways to secure their interest in the underlying collateral.

Lease financing

Finance companies found the leasing market to be much more hospitable territory than the consumer installment credit market. Finance companies started out with a market share twice that of banks and ended up with a share perhaps three times the share of banks (Chart 8).[11] Most of the banks' share took the form of nonoperating leases because until late in the period, Federal Reserve Regulation Y limited banks to leases that were economically equivalent to loans.[12] During the decade, finance company leasing receivables grew 18 percent a year. Most of the increase in absolute terms was in equipment leasing, although auto leasing receivables grew at a faster rate.

[11]More precise comparisons are difficult because the data are gross receivables for finance companies and net receivables for banks. However, an adjustment for the difference between gross and net would not change the figures by more than 20 percent.

[12]Under Section 225.25 (b) 5 for permissible nonbanking activities, the leases must be structured to transfer ultimate ownership of the asset to the lessee or to expose the lessee to most of the asset risk. Regulation Y stipulated that the residual value of the leased asset not exceed 20 percent of the acquisition cost.

Table 6
Factoring Volume
Millions of Dollars

	1985	1990	Annualized Percentage Change
Bank-related factors			
CIT Group/Factoring	5,800	6,751	3.1
BNY Financial Co.	4,664	6,200	5.9
Citizens & Southern Commercial	4,449	5,800	5.4
Heller Financial	3,300	6,501	14.5
BancBoston Financial	2,967	3,444	3.0
BarclaysAmerican Commercial	2,582	3,843	8.3
Congress-Talcott Factors	2,269	4,110	12.6
Republic Factors	1,750	4,200	19.1
Trust Co. Bank	1,543	2,906	13.5
Ambassador Factors	475	760	9.9
Midlantic Commercial	445	843	13.6
Standard Factors	143	151	1.1
Total	30,387	45,509	8.4
Non-bank-related factors			
Rosenthal & Rosenthal	730	1,160	9.7
Milberg Factors	675	860	5.0
Century Business Credit Corp.	460	901	14.4
Total	1,865	2,921	9.4

Source: *Daily News Record*, February 13, 1991, p. 9.

Notes: Volume is the cumulative dollar value of accounts factored during the year. The volume numbers in 1985 are adjusted for subsequent mergers.

The strong demand for equipment leasing in the 1980s stemmed from tax incentives. The Economic Recovery Tax Act of 1981 provided for a faster write-off of capital expenditures under simplified and standardized rules. The leases offered by finance companies were a way to shift the tax benefits of accelerated depreciation to the companies that had the income to shelter. Banks, however, could offer only nonoperating leases and thus could not shelter their own income.

Later in the decade, the corporate leveraging trend probably added to the demand for equipment leasing. The banks themselves contributed to this demand by their participation in highly leveraged transactions. Debt-burdened firms strapped for cash could turn to sale leasebacks to raise funds at a lower cost than that demanded in other debt markets. Unless the sale of equipment was prohibited by existing loan covenants, the sale leaseback enabled a lessee to borrow more cheaply by effectively offering the lessor seniority with respect to the leased asset. The cheaper cost of borrowing would come at the expense of other creditors, who would lose their seniority with respect to the asset.

In the main equipment leasing niches of finance companies—commercial aircraft, construction equipment, machine tools, and medical equipment—dynamic economies of scale in information are indeed important. Information about the value of the equipment over its economic life is crucial for assessing contracts. Most of the gains and losses in the business turn on having the proper estimates of residual value. In the event of default on an operating lease, the lessor already owns the asset and can easily repossess it, but knowing how to manage a repossessed asset becomes essential.

Finance companies arrived in these niches well ahead of banks and over time accumulated valuable information and developed the expertise necessary to operate effectively in the market. The importance of such information and the difficulty of acquiring the requisite expertise quickly may have given finance companies their most effective defense against bank competition. The experience banks had in securing their interest in financial forms of collateral provided no advantage in a market where repossession was so easy; at the same time the banks were short of experience in the critical area of managing repossessed physical assets.

Economies of scope

A few finance companies may have had an informational advantage in the equipment leasing market because they were owned by the equipment manufacturers. If the residual value of a type of equipment depended critically on the development of new models, it would obviously help a lessor to know what was on the drawing boards. IBM Credit offers a prime example

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

of such economies of scope in its ties with its parent.[13] These economies, however, appear to be less significant for other major leasing companies. GE Capital, for example, found it advantageous to acquire an existing aircraft leasing finance company, Polaris, even though its parent manufactured aircraft engines.

Breaking through the niche barrier

Bank strategies

Two basic strategies were available to commercial banks wishing to expand into the leasing niches of finance companies. First, banks could have hastened to develop their own expertise through rapid expansion in the niche markets. Second, banks could have purchased the necessary expertise by acquiring existing finance company operations. To succeed, either strategy would have required a cost-of-funds advantage to offset the costs of entry. The first strategy entails the costs of learning from experience, the second strategy the cost of a takeover premium. Moreover, even a significant cost-of-funds advantage would not have ensured the banks' success. The restrictions imposed by Regulation Y and the difficulties of integrating two different operating cultures presented additional hurdles to entry into the leasing niches.

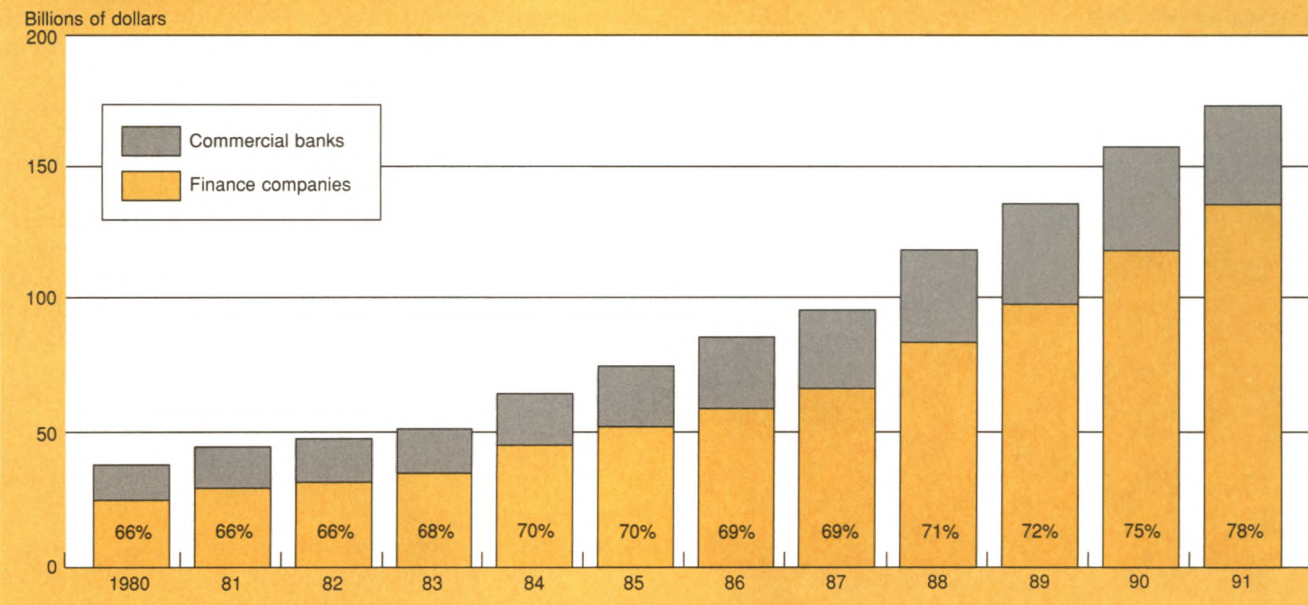
[13]The company's 1991 annual report states, "IBM Credit manages residual value risk by developing realistic projections of future values based on carefully monitoring IBM product plans, competitive announcements, and actual remarketing results" (p. 15).

The strategy of rapid expansion

If banks had had a sufficient cost-of-funds advantage, they could have tried to catch up on the learning curves in the leasing markets by expanding rapidly on their own. Chart 9 depicts a lower cost of funds for banks by placing their dynamic cost curve below that for finance companies. Thus the banks may start at a unit cost of c_1, which is higher than c_2, the unit cost faced by finance companies. A sufficiently rapid expansion from q_1 to q_3 would bring the banks to a point on their curve that gave them the unit cost c_3, which is now lower than the finance companies' c_2. The higher returns the banks would then get would make up for the losses they incurred in pushing their way into the market. In a fast-growing market, this strategy would have a better chance of success if finance companies were already in the flat part of their learning curves, because the banks would not be chasing a moving

Chart 8

Leasing Receivables



Source: Board of Governors of the Federal Reserve System, *Federal Reserve Bulletin.*

Notes: Because leasing data for commercial banks are reported on a net basis, the data are increased by 20 percent to approximate gross amounts. Percentages appearing in the bars indicate finance company share of total leasing activities by banks and finance companies.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

cost target.

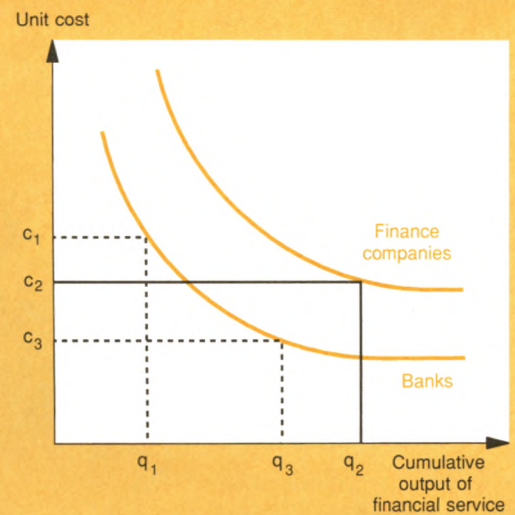
Banks do report much lower average interest expenses and operate on much narrower average capital ratios than do finance companies. These differentials, however, represent an intramarginal cost advantage for banks, arising partly from the banks' ability to issue low-rate insured deposits. The relevant cost for competing in new markets is the cost of funds *at the margin*, and here it is less obvious that banks have had a significant advantage.

Borrowing costs

The marginal cost of debt in the 1980s appears to have been very similar for finance companies and banks. Finance companies funded themselves at the margin largely by issuing CP and corporate bonds, while banks funded themselves by issuing large certificates of deposit (CDs). In the middle business credit market, the banks' main rivals would have been the prime CP issuers, many of which enjoyed the ratings support of industrial parents. For most of the decade, prime CP rates and bank CD rates moved virtually together (Chart 10). In addition to paying the CP interest rate, finance companies would have paid commitment fees for backup credit lines and placement fees. For their part, banks would have paid deposit insurance premiums and the cost of required reserves. These borrowing costs would not have given banks a cost-of-funds differential to offset any noninterest cost advantage finance companies may have had in their niche markets.

Chart 9

Strategy for Banks with Cost of Funds Advantage



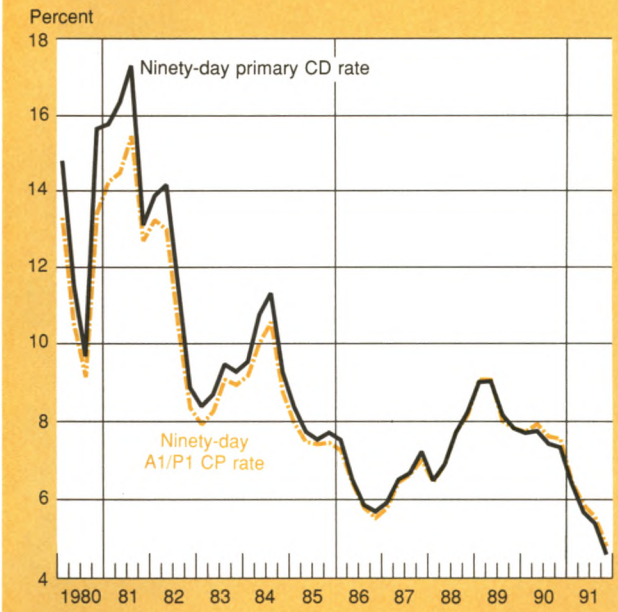
To illustrate, the average interest rate on prime CP from 1986 to 1990 was 7.23 percent. In addition, finance companies would pay perhaps 20 basis points in fees to banks providing the backup credit lines and 5 more basis points to place the paper, resulting in an all-in cost of 7.48 percent. For their part, commercial banks issued their large CDs at an average interest rate of 7.27 percent. In addition they would pay about 8 basis points for deposit insurance and 24 basis points for the cost of the 3 percent reserve requirement on large CDs (the requirement was reduced to zero at the end of 1990). Thus banks incurred an all-in cost of 7.58 percent. This calculation gives finance companies a 10 basis point advantage in borrowing costs; actual costs may have been slightly different, but they are not likely to have given banks a substantial advantage.

Capital and leverage

The cost of funds also depends on leverage and the cost of equity. The true amount of capital held by finance companies that are wholly owned subsidiaries is difficult to calculate because much of a subsidiary's capital tends to be in the form of an option on the parent's capital. Nonetheless, a superficial analysis of the finance companies' booked capital in the second

Chart 10

Rates for Commercial Paper and Bank Certificates of Deposit



Source: Data Resources International.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

half of the 1980s suggests that the more successful finance companies did not necessarily suffer a disadvantage relative to banks in terms of leverage and the cost of capital. Although banks operated on narrower average capital ratios, finance companies were able to raise their leverage and thus operate at the margin on capital ratios not far from those of banks.

For most of the large finance companies, growth was accompanied by a decline in capital-to-asset ratios without corresponding downgrades in credit ratings. The fast-growing firms that sharply leveraged up were thus able to expand on relatively narrow marginal capital ratios (Table 7). Five firms—Toyota Motor Credit, IBM Credit, American Express Credit, Westinghouse Credit, and Ford Motor Credit—increased their leverage to the point of placing their capital ratios at or below the median for the group of fast-growing firms. Their marginal capital ratios from 1985 to 1990 ranged from 4.9 percent for IBM Credit to 11.6 percent for Toyota Motor Credit, and as a group their ratio was a mere 6.5 percent. Of the five, only Westinghouse Credit suffered a credit rating downgrade; indeed, Ford Motor Credit managed to obtain upgrades for its senior debt and commercial paper. The largest fast-growing firm, GE Capital, did not expand by increasing its leverage, but it had a low capital ratio of 10 percent from the start and it maintained this ratio as it grew. Its size and asset quality apparently allowed it to keep the highest ratings for its debt.

Financial ties to industrial parents evidently allowed some of the finance companies to raise leverage without sacrificing their credit ratings. These companies, however, cannot increase their leverage indefinitely, and beyond a leverage limit, they will lose the concomitant benefit in marginal funding costs.

These marginal capital ratios were sufficiently close to those of banks to give finance companies with access to cheap equity financing a cost of funds about on par with that of banks, particularly at a time when these banks were facing loan quality and capital adequacy problems.[14] Relatively cheap equity capital was often available to the subsidiaries of industrial firms because in the 1980s, U.S. industrial firms enjoyed higher price-earnings ratios than did commercial banks

[14] In 1986, for example, the large U.S. banks started provisioning heavily for their less developed country (LDC) loans.

Table 7

Finance Company Leverage

	Capital/Asset Ratio (In Percent) 1985	Capital/Asset Ratio (In Percent) 1990	Change in capital/ Change in assets (In Percent) 1985-90
Fast-growing companies			
General Electric Capital Corp.	10.0	9.9	9.9
Ford Motor Credit	10.4	8.4	6.1
Household Financial	15.1	15.8	16.7
Associates Corp.	17.8	14.4	11.5
American Express Credit	15.1	11.5	8.3
ITT Financial Corp.	20.3	17.9	15.4
I.B.M. Credit	12.2	8.2	4.9
Westinghouse Credit	18.1	12.4	7.1
Security Pacific Financial Service	13.3	13.7	13.9
Transamerica Finance	26.6	25.2	24.9
Heller Financial	22.5	20.2	18.3
American General Finance	22.1	22.8	22.9
Toyota Motor Credit	23.3	12.3	11.6
Median	17.8	13.7	11.6
Slow-growing companies			
General Motors Acceptance Corp.	8.7	7.8	5.4
Chrysler Financial	17.7	15.8	12.4
Sears Roebuck Acceptance Corp.	22.2	18.7	12.6
CIT Group	13.7	14.9	3.2
Commercial Credit	14.5	14.3	11.9
Beneficial Corp	12.6	10.6	−19.4
Avco Financial	19.5	17.4	30.0
John Deere Credit	22.0	27.7	50.9
Median	16.1	15.3	12.2

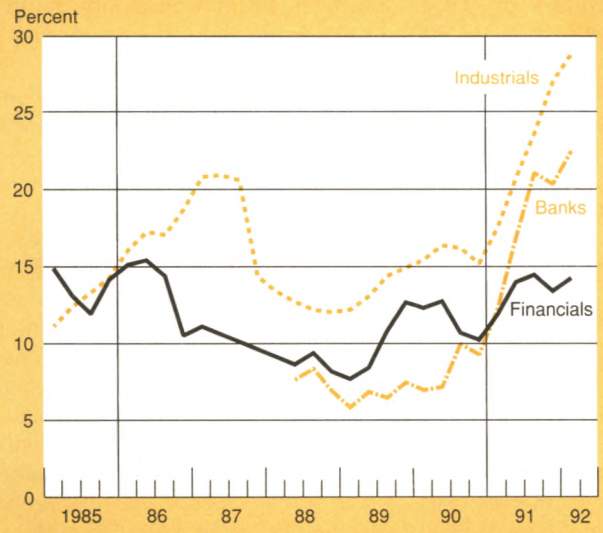
Source: *American Banker.*

Note: In each growth category, finance companies are ranked by size.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Chart 11

Price/Earnings Ratios



Source: Standard and Poor's Corporation.

(Chart 11). In particular, GE Capital, IBM Credit, and Toyota Motor Credit seem to have combined access to low-cost equity through industrial parents with relatively narrow marginal capital ratios to at least match the cost of capital for most large U.S. banks.[15]

Operating culture

Some bank holding companies would have had difficulty integrating a leasing operation's activities with the whole organization's credit review process. In making credit decisions, commercial banks rely on information about the borrower's financial condition, while finance companies offer a lease based simply on the value of the collateral and the equity stake of the lessee in the equipment. The banks' credit process seems to work effectively in the factoring market, where banks continue to dominate, but not so well in leasing, where a

[15]An example will clarify how the cost of funds is calculated for banks and finance companies. In the case of banks, a marginal capital ratio of 0.07, a cost of debt of 7.5 percent, and a cost of equity of 18 percent would give a weighted cost of funds of 8.24 percent. In the case of finance companies, a marginal capital ratio of 0.10, a cost of debt of 7.5 percent, and a cost of equity of 15 percent would give a cost of funds of 8.25 percent, virtually the same as that of banks.

Table 8

Twenty-Five Largest Acquisitions of Finance Company Assets, 1980-91

Target	Target's Main Activity	Acquiring Company	Date	Value (Millions of Dollars)
Associates Corp.	Consumer credit	Ford Motor Co.	10/89	3,350
Ford Motor Credit (real estate receivables)	Real estate	Associates Corp.	1/91	2,200
CIT Group	Factoring	Manufacturers Hanover Corp.	4/84	1,510
Macy	Credit cards	General Electric Capital Corp.	5/91	1,400
Barclays American/Financial	Consumer credit	Primerica Corp.	3/90	1,350
Meritor	Consumer credit	Ford Motor Co.	3/89	1,300
CIT Group	Factoring	Dai-Ichi Kangyo Bank	12/89	1,280
Henley Group	Leasing	Itel Corp.	9/88	1,194
Chase Manhattan	Leasing	General Electric Capital Corp.	1991	1,024
Bank of New England	Communications lending	Canadian Imperial Bank	4/90	1,000
Itel Corp. (leasing receivables)	Leasing	General Electric Capital Corp.	1991	917
Bank of New England	Credit cards	Citicorp	2/90	828
Commercial Credit	Commercial finance	Security Pacific Corp.	6/85	800
Chase Manhattan Leasing Co.	Leasing	Associates Corp.	9/91	800
BWAC	Commercial finance	Transamerica Corp.	11/87	783
Manufacturers Hanover Consumer Services	Consumer finance	American General Corp.	5/88	685
Signal Capital Corp.	Equipment finance	Fleet/Norstar Financial Group	8/89	674
C. T. Bowring & Co.	Consumer credit	Marsh & McLennan Cos. Inc.	7/80	569
Shawmut (credit card receivables)	Credit card receivables	Norwest Corp.	1/91	568
Fidelcor Business Credit Corp.	Commercial finance	CIT Group	2/91	502
Lomas Bankers Corp.	Consumer credit	LBC Acquisition Corp.	8/89	500
PacifiCorp Credit Inc.	Leasing and financing	AT&T	1/90	460
McCullagh Leasing Inc.	Leasing and commercial finance	General Electric Co.	2/90	450
Walter E. Heller International	Factoring	Fuji Bank Ltd.	1/84	425
BankAmerica Corp. (Finance America subsidiary)	Consumer credit	Chrysler Corp.	11/85	405

Sources: Automatic Data Processing; annual reports.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

physical asset is involved. Most banks have not been set up for the active management of physical assets. If a lessee defaults, a finance company lessor would typically be better prepared than a bank lessor to take the asset back and to find the use for it that best allowed recovery of the investment.

Regulation Y

Until the latter part of the 1980s, Federal Reserve Regulation Y would have made it difficult for banks to expand into operating leases. This regulation limited nonbank subsidiaries of bank holding companies to providing only nonoperating leases, a restriction that deprived banks of the tax advantage of operating leases. National banks were subject to restrictions imposed by the Office of the Comptroller of the Currency (OCC). During the latter half of the decade, the OCC restrictions were less stringent than those of Regulation Y. Bank holding companies, however, could apply to engage in operating leases. By 1989, Regulation Y had been sufficiently relaxed so that it no longer served as a binding constraint on banks' leasing activities.[16] By then, however, new capital standards under the Basle Accord, problems with loan portfolios, and a cost of equity disadvantage placed large banks at a serious disadvantage in expanding into the leasing market.

The acquisition strategy

Efforts by banks and other firms in the 1980s to acquire existing finance company operations provide indirect evidence of the difficulties of penetrating the leasing niches of finance companies. The acquisition strategy, like the strategy of self expansion, faced hurdles of funding costs, operating cultures, and Regulation Y.

The decade saw a total of perhaps $30 billion in deals that resulted in acquisitions of finance company assets. Of the twenty-five largest acquisitions since 1980, seven were of leasing operations (Table 8). Of these, only one—the acquisition in 1989 of Signal Capital's equipment leasing business by Fleet Norstar—was an acquisition of a leasing business by a bank holding company. Indeed two other acquisitions took the opposite direction: Chase Manhattan sold one leasing operation to GE Capital and another operation to Associates, two acquirors with industrial parents. The banks' large acquisitions were most often factoring and consumer businesses. Industrial firms tended to acquire leasing and other business credit operations.

Fleet Norstar's acquisition of a leasing business, though unusual, suggests that this bank, at least, perceived itself as having a cost-of-funds advantage. In addition, Fleet Norstar may have escaped the difficulties posed by differences in operating culture because at the time of the acquisition, it already had a substantial leasing operation of its own. Finally, the takeover shows that by 1989 Regulation Y was not an absolute barrier to expansion in the equipment leasing market.

Conclusion

Many observers interpret the apparent success of large finance companies in competition with banks as evidence of the advantages enjoyed by unregulated financial intermediaries with ties to industrial parents. Any such advantages, however, would not readily explain why finance companies would outperform banks in some credit markets but not in others: in the 1980s, finance companies gained in the middle market for business credit, while banks gained on finance companies in the consumer credit market. This article suggests that this differential performance was driven largely by structural features of specific markets rather than institutional differences between banks and finance companies.

Finance companies saw their most impressive gains in their leasing niches, where their long involvement gave them important advantages in market information. Success in credit market segments that were among the fastest growing in the United States allowed finance companies to outstrip banks overall. While niche information was the source of the finance companies' advantage in leasing markets, large-scale data processing technologies provided banks with their own advantage in the consumer installment credit market.

Institutional factors of regulation and ownership do help explain why banks were so slow to take advantage of opportunities in the fast-growing leasing markets. In the 1980s, Regulation Y and an alien operating culture served to inhibit bank entry into these markets. These impediments, however, did not prevent some banks from penetrating these markets successfully. It appears that the critical barrier for most banks was their lack of a cost-of-funds advantage. In the 1980s, the importance of funding costs was heightened by the ability of potential finance company rivals to increase leverage and raise cheap capital, often by exploiting financial ties to industrial parents. At the same time, many large banks saw their own cost of capital rise because of loan quality problems and tightened capital adequacy standards. Had the banks maintained a stronger capital base, they would have been in a better position to compete in the niche markets of other financial intermediaries.

[16] In May 1992 the leasing restrictions of Regulation Y were made comparable with the OCC's rules.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Manufacturing Productivity and High-Tech Investment

by Charles Steindel

Labor productivity in U.S. manufacturing soared in the 1980s. From 1983 to 1989, output per employee in manufacturing[1] grew at an annual average of 5 percent, compared with 1.1 percent in 1974-82 and the pre-1974 average of 3 percent (Table 1).

No satisfactory explanation for the acceleration in manufacturing productivity has emerged. Net fixed capital per worker in manufacturing showed scant growth in the 1980s. The gross capital-labor ratio was also little changed.[2] Reflecting the lack of capital deepening, multifactor productivity—productivity not accounted for by labor and capital inputs—advanced at a record pace in the 1980s.

The increased growth of productivity in manufacturing is in sharp contrast to its continued weakness in the rest of the economy. Output per employee in the nonfarm, nonmanufacturing sector grew at only a 0.4 percent rate in the 1980s expansion, down from a pre-1974 average of 1.6 percent.

Conceivably, the improvement in manufacturing productivity could have been linked to increased use of high technology. There is a widespread feeling that the manufacturing sector went through significant technological changes in the 1980s. Rather surprisingly, however, data at the simplest level do not suggest any technology surge in manufacturing in the 1980s. "Information-processing" equipment—computers and other office machinery, communication equipment, and technical instruments—accounted for a much smaller share of the capital stock in manufacturing than elsewhere, and per worker growth in the stock of this equipment actually slowed in the 1980s.

Still, despite the rather unimpressive data on capital stock growth, high-tech capital may have made a significant contribution to the improvement in manufacturing productivity. This article explores in more depth some of the issues connected with productivity growth and "high-tech" capital.[3] It finds some evidence of a positive relationship between high-tech capital usage and productivity in manufacturing industries. The relationship is sufficiently large to account for a nontrivial fraction of the growth of productivity in manufacturing industries from the first to the second half of the 1980s, even though other factors played more substantial roles and the bulk of the acceleration in productivity growth remains difficult to explain.

The first section of the article examines how economists conventionally view the possible connections between high-tech capital and output. This conceptual material is followed by an empirical examination of the linkage of high-tech capital stocks and investment flows to the productivity of manufacturing industries.

[1]This measure differs from the commonly reported Bureau of Labor Statistics productivity series because it measures the input of labor as full-time equivalent employment rather than hours worked. The data in this article do not incorporate the recent benchmark revision of the National Income and Product Accounts, since the revised historic data on output by industry are not available.

[2]The net capital stock measures the resource costs of replacing the (straight-line) depreciated value of the equipment and structures currently in service. The gross capital stock measures the same costs without corrections for depreciation.

[3]Throughout this article the terms "high technology" and "computers" will be used interchangeably with the term "information-processing equipment." In the late 1980s spending on computers accounted for about one-third of current-dollar, and two-thirds of constant (1982)-dollar, investment in information-processing equipment by all private firms.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

The contribution of high-tech capital to output

As noted above, the stock of high-tech capital in manufacturing actually grew more slowly in the 1980s than in the previous decade. However, growth in the aggregate productivity of high-tech capital depends not only on changes in the size of the stock but also on trends in the productivity of each item in the stock. The productivity of a high-tech or other capital good is properly measured by the value of what it helps to produce, not by the amount of technology built into the equipment. For example, the productivity of an automated teller machine should be judged by the value of the convenience it affords customers, allowing them to carry around a plastic card rather than cash. The value of this convenience is not necessarily measured by the sophistication of the machine's electronics (a bank could provide essentially the same service by keeping its branches open twenty-four hours a day).

It is usually not possible to measure the productivity of a capital good directly. Many economists calculate the productivity of capital goods by using the techniques of the standard neoclassical model. This approach leads to the finding that the plunging prices of high-tech capital goods imply that the goods' productivity has been falling at a very rapid rate.

Although this result seems suspicious, the logic of the neoclassical model merits some exploration, since it has proven highly useful in many studies of capital formation and growth. The neoclassical model assumes that capital markets are in equilibrium—that the returns from all investments are equalized. In the example above, the return a bank makes from installing an additional automated teller machine would equal the return from investing the same amount in extending branch hours. If the returns were not equal, capital would be redirected to the more productive outlet up to the point where, given diminishing returns, the returns from the different investments were equalized. More significant, the two returns would also equal the return the bank would realize from investing that amount in a financial instrument.

The return on a dollar investment in an item of high-tech capital is essentially determined by multiplying the productivity of the item by the price of the output it yields, and then dividing the product by the price of the high-tech good. The assumption of the neoclassical analysis is that this return equals the return from a dollar investment in a financial instrument (which may be approximated by some representative interest rate).[4] From the equality of the two returns the productivity of the high-tech capital good can be readily deduced (for

[4]In actual use of the neoclassical model, consideration is given to such matters as the tax implications of physical and financial investment, the useful life and rate of deterioration of the capital good, possible costs and delays in installing the capital good, and the differing productivities of capital installed at different times.

Table 1

Growth Rates of Productivity and of Labor and Capital Inputs

	1950-73	1974-82	1983-89
Manufacturing sector			
Labor productivity	3.0	1.1	5.0
Net capital per employee	2.6	4.4	0.2
Gross capital per employee	2.4	4.8	1.3
Net high-tech capital per employee	2.3	20.2	7.9
Multifactor productivity	2.2	0.0	4.7
Memo: Level of net high-tech capital per employee, 1982 dollars			
1980: $1567			
1989: $4163			
Nonmanufacturing sector			
Labor productivity	1.6	−0.6	0.4
Net capital per employee	1.5	1.0	−0.3
Gross capital per employee	0.6	1.2	0.1
Net high-tech capital per employee	7.2	6.7	8.8
Memo: Level of net high-tech capital per employee, 1982 dollars			
1980: $3719			
1989: $8204			

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

convenience, this will be referred to as the "equilibrium" productivity).[5] If the price of high-tech capital falls and the output price is unchanged, one should infer a corresponding decline in the capital good's equilibrium productivity—that is, its economic productivity, not its physical or technical capacity. The reasoning is that an investor can buy a greater quantity of the good for a given dollar amount of investment because the price of the good has dropped; if there is no corresponding drop in its productivity in value terms, the investor will earn an above-market return. Put somewhat differently, the implication of the neoclassical analysis is that if the price of a high-tech good has fallen, market forces will push that good into lower valued uses, thus inviting the conclusion that its productivity in value terms has fallen.

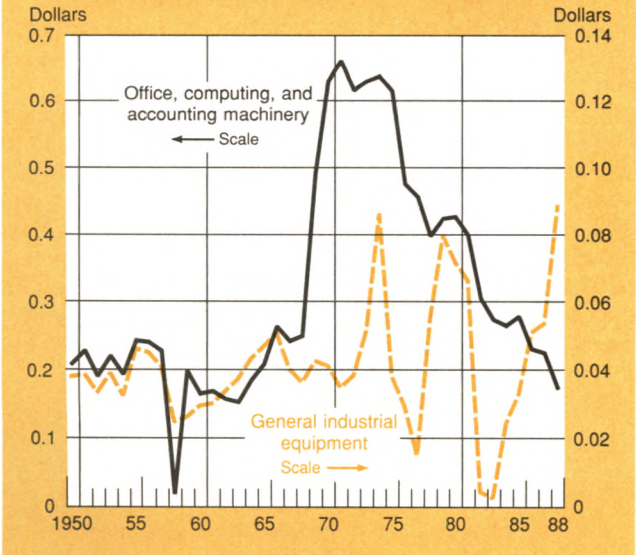
It is generally recognized that the price of high-tech equipment, especially computers, has fallen very sharply. Analysts who use the neoclassical procedure to calculate the equilibrium productivity of high-tech capital therefore find that it has fallen. Charts 1 and 2 illustrate the decline in the equilibrium productivity per dollar of real investment (a dollar of real investment corresponds to a standardized "item"). Chart 1 plots the equilibrium productivity of office, computing, and accounting machinery for the primary metals industry, as calculated by the Bureau of Labor Statistics, and compares it with the productivity of industrial equipment in this industry. Chart 2 compares the productivity of computers for retail trade with that of commercial buildings in that industry. (The computer productivities in retail trade and primary metals differ slightly because the two industries have differing costs of funds.) In both instances the equilibrium productivity of computers—again, as measured in the neoclassical framework—rose through the late 1960s, primarily because the relative cost of computers grew in that period. Over the last generation, however, the equilibrium productivity on computers has plunged, while that on the alternative assets either has been highly volatile (for industrial equipment in primary metals) or has risen substantially (in the case of retail commercial buildings).

What implications should be drawn from the decline in the equilibrium productivity of computers? The proxi-

[5]The calculated productivity is often termed the "real rental rate." The term "rental rate" is used because in full equilibrium the current-dollar amount the owner earns from a capital good each period will equal the amount for which it would be rented out. The "real rental rate" is then the productivity associated with the appropriate current-dollar return. For discussions of the rental rate concept and its measurement, see Robert N. McCauley and Steven A. Zimmer, "Explaining International Differences in the Cost of Capital," this *Quarterly Review*, vol. 14 (Summer 1989), pp. 7-28; and James M. Poterba, "Comparing the Cost of Capital in the United States and Japan: A Survey of Methods," this *Quarterly Review*, vol. 15 (Winter 1991), pp. 20-32.

Chart 1

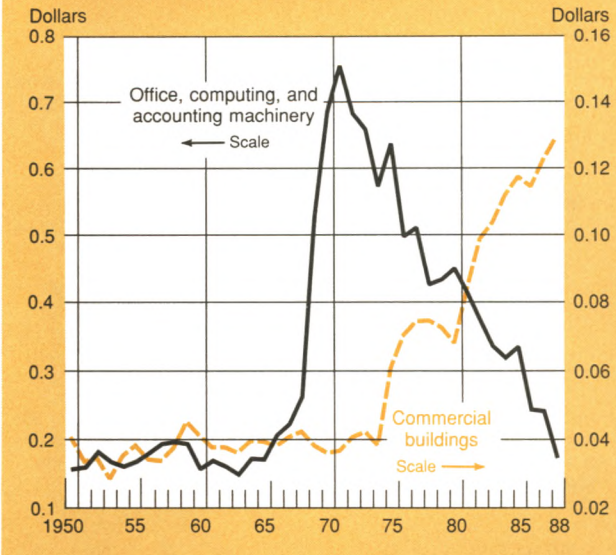
Equilibrium Productivity per Dollar of Real Investment in Primary Metals



Source: Bureau of Labor Statistics.

Chart 2

Equilibrium Productivity per Dollar of Real Investment in Retail Trade



Source: Bureau of Labor Statistics.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

mate causes, of course, have been the tremendous increase in competition and improvements in the production process in the computer industry, developments that together have driven down prices. From the strict neoclassical perspective, however, a key point is the simple fact of the price decline—if the calculation is correctly done, and if markets are in equilibrium, the output gain from an investment in computers has plunged. By this method of reckoning, the decline in the equilibrium productivity of computers has offset much of the increase in their stock; thus, computers did much less to advance growth in the 1980s than the increase in their number would suggest.[6]

Many people would intuitively resist the idea that greater investment in computers has contributed little to productivity growth; similarly, they would question whether rapidly declining computer prices offer any support for this conclusion.[7] Surprisingly, the first objection that they might raise—the obvious increase in the sheer technical sophistication of computers—is not really relevant. The productivity estimates shown in the charts apply to hypothetical computers of standardized processing power, and the price index used in the calculation refers to the prices of such machines. A computer that has five times the processing power of the standardized machine is considered five machines for the purpose of this analysis. Such a machine is obviously more productive than a single standard machine, but the issue is whether it is more or less than five times as productive. Furthermore, as noted above, productivity is defined by the aid an item gives to final production, not by the technology built into it.

[6]The charts do suggest that the equilibrium productivity of computers remained above that of some other capital goods throughout the decade. (Note the different scales for the two types of goods in each chart.) Thus, the shift in the composition of the capital stock to computers could have had a beneficial effect on growth, even if the productivity of computers was falling.

[7]Conceivably, of course, high-tech investment could have indirectly contributed to growth by increasing the rate of technical progress. For instance, computerization could lead to efficiencies in overall operations by speeding up routine clerical work and freeing management time for strategic planning. The problem with this argument from the standard perspective is that the benefit of auxiliary economies should ultimately be reflected in the price of high-tech equipment. If such benefits exist, the demand for the equipment should increase accordingly, putting upward pressure on the price even if there is a lag between the purchase and the benefit. The price of the equipment, however, has declined rapidly for many years, suggesting that the connections between high-tech investment and technical progress are not clearly evident in the marketplace.

Another argument is that high-tech investment in one industry may lead to increased technical progress in other industries through "spillover" effects. A recent study is skeptical that such spillovers are important. See Zvi Griliches, "The Search for R&D Spillovers," National Bureau of Economic Research, Working Paper no. 3768, July 1991.

Even though this class of objections has little merit, the neoclassical analysis is still questionable. Granted, many computers are now being used in low-productivity environments (such as home entertainment), and in all probability, the productivity in value terms of increments to the stock of computers is lower today than in the past. It is hard to believe, however, that the productivity per unit for the installed stock of computers has fallen as rapidly as the charts suggest.

In fact, the productivity of computers may have remained much stronger throughout the 1980s than the neoclassical equilibrium productivity calculations would suggest. First, the rapidity of the computer price decline may be questioned. The computer price index essentially estimates the cost of a standardized unit of processing power. The measure is potentially subject to pure statistical error. Furthermore, the index may not capture trends in the costs associated with the purchase of a computer, such as expenditures for software, installation, and training. These costs may well have increased relative to hardware costs. Thus, the true cost of acquiring a computer, while surely reduced, may have fallen less than suggested by the official price index.

In addition, the assumption that the markets for computers and other high-tech equipment are in equilibrium may not hold. If a market for a capital good is to be in a true equilibrium, both buyers and sellers must be fully aware of the good's technical characteristics (such as its useful life and rate of physical decay) and productive potential (such as the products it helps to make). Given the remarkable changes over the last decade in both the design and use of computers, it is hard to believe that the market for computers has achieved that sort of equilibrium. The actual productivity trend for computers in service could well have been stronger than the equilibrium productivity calculation implies.

Other problems with the equilibrium productivity measure emerge when we look carefully at explanations for the continued rapid growth of investment in high-tech equipment. The common sense notion is that this type of investment has been growing because for many businesses, the productivity of the equipment remains high relative to its costs. Analysts using the neoclassical model emphasize instead that the price decline is even more pronounced than the decline in productivity.[8]

[8]The price effect is emphasized in Yolanda K. Henderson and Jeffrey B. Liebman, "Capital Costs, Industrial Mix, and the Composition of Business Investment," Federal Reserve Bank of Boston *New England Economic Review*, January-February 1992, pp. 67-92.

A recent analysis using the neoclassical approach finds that in most manufacturing industries the benefits attributable to investment in high-tech capital are smaller than the costs, even when a possible feedback from high-tech investment to technical progress is taken into account. This finding raises the question why high-tech investment continues to grow rapidly (Catherine J.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Although this emphasis may be logical at a formal level, one finds it hard intuitively to justify rapid growth in spending on goods whose productivity is falling as rapidly as the neoclassical calculation suggests.

On the whole, the conventional neoclassical result that high-tech capital has had little to do with growth appears to rest on some strong and questionable assumptions. Studies less wedded to the strict neoclassical approach are more supportive of the notion that investment in high-tech capital has contributed importantly to economic growth. In particular, some studies have presented evidence that investment in computers has helped manufacturing firms achieve significant cost savings and faster productivity growth—to a greater extent, perhaps, than in the case of nonmanufacturing firms.[9] The findings of these studies make it advisable to assess the statistical connection between manufacturing industry productivity, overall capital intensity, high-tech capital intensity, and investment in high-tech capital. The next section, then, is designed to quantify the role of high-tech capital formation in accelerating manufacturing productivity during the 1980s.

The linkage of industry productivity and high-tech capital: framework and statistical evidence

Empirical studies of the link between productivity and computerization in the neoclassical tradition rely upon formal and well-articulated models of the connections between inputs and outputs. Essentially, the neoclassical method employs several restrictive assumptions (for example, a known rate of decline in the physical productivity of the asset) to calculate a complex measure of high-tech capital use. As noted earlier, such methods may not be appropriate to apply to new and rapidly changing capital such as high-tech equipment.

An analyst seeking an alternative to the more rigorous and formal neoclassical approach might look for significant correlations between output—or, alternatively, labor productivity, the ratio of output to labor—and simple measures of high-tech capital use. The strategy employed in this article is to test whether measures of high-tech capital use that do not incorporate all the neoclassical assumptions help explain industry labor productivity trends.

Economists generally hold that labor productivity is positively related to overall capital intensity (and to factors such as the state of the business cycle and trends in the state of technical knowledge). The question addressed in this analysis is whether different degrees of high-tech equipment use help explain differences in labor productivity levels across industries at one point in time, and whether differing trends in the use of high-tech equipment help to explain differing trends in labor productivity growth. Accordingly, this section reports the results of several pooled time-series/cross-section regressions of the form

$$ln\left(\frac{Y_{it}}{L_{it}}\right) = a ln\left(\frac{K_{it}}{L_{it}}\right) + b ln\left(\frac{HK_{it}}{L_{it}}\right) + c + d_i t + e ln(CUR_t),$$

where

Y_{it} = real gross output in industry i in year t

L_{it} = full-time equivalent employment in industry i in year t

K_{it} = a measure of the aggregate capital used in industry i in year t

HK_{it} = a measure of the use of high-tech equipment in industry i in year t

CUR_t = the overall capacity utilization rate in manufacturing in year t.

The first coefficient, a, will measure the percentage increase in an industry's labor productivity from a 1 percentage point increase in the industry's ratio of capital to labor, irrespective of what type of capital is purchased. The normal expectation is that this coefficient will be somewhere around .25, or at least in a range between 0 and .5.

Coefficient b measures the percentage increase in labor productivity arising from a 1 percentage point increase in the ratio of high-tech equipment use to labor when the industry's capital stock is held constant. The total effect of high-tech equipment on output combines coefficients a and b in a rather complex way: the combination will not be in simple additive form both because

Footnote 8 continued
Morrison and Ernst R. Berndt, "Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing Industries," National Bureau of Economic Research, Working Paper no. 3582, January 1991; see also Berndt, Morrison, and Larry S. Rosenblum, "High-Tech Capital Formation and Labor Composition in U.S. Manufacturing Industries: An Exploratory Analysis," National Bureau of Economic Analysis, Working Paper no. 4010, March 1992).

[9]For example, see Stephen S. Roach, "Pitfalls on the New Assembly Line: Can Services Learn from Manufacturing?" Morgan Stanley and Company, Special Economic Study, June 22, 1989, and the same author's comment on "Recent Trends in Capital Formation," by Charles Steindel, in Charls E. Walker, Mark Bloomfield, and Margo Thorning, eds., *U.S. Investment Trends: Impact on Productivity, Competitiveness, and Growth* (Washington: D.C.: American Council for Capital Formation Center for Policy Research, 1991), pp. 53-60; Martin N. Baily and Robert J. Gordon, "The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power," *Brookings Papers on Economic Activity*, 1988:1, pp. 347-420; and Donald Siegel and Zvi Griliches, "Purchased Services, Outsourcing, Computers, and Productivity in Manufacturing," National Bureau of Economic Research, Working Paper no. 3678, April 1991.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

the equation involves logarithms and because the measure of high-tech equipment use in the second term may not be the same as that counted in the capital stock data.

Coefficient c is a constant term designed to capture the effects of omitted common factors affecting productivity in all industries. Coefficient d_i measures the effect of the passage of time on productivity in industry i; this term is intended to measure the effects of technical progress and knowledge (which are typically assumed to grow smoothly over time) on an industry's productivity. In more sophisticated models, technical progress has been explained by the growth of factors such as research and development expenditures, patents, and the skill levels of an industry's work force.

Coefficient e measures the effect of aggregate demand relative to potential on productivity. The overall index of capacity utilization in manufacturing, CUR_t, would be an appropriate index of the status of aggregate demand as it affects manufacturing. This coefficient would be expected to be positive: productivity is known to be highly procyclical, as is capacity utilization.[10]

Variations of the proposed model were estimated for the manufacturing sector, including all industries for which data were available in the National Income and Product Accounts.[11] The reported regressions use the start-of-year real net capital stock as the measure of the aggregate industry capital input.[12]

The high-tech capital effects—the HK_{it} terms—were modeled by a number of different variables. The first and most obvious one was the start-of-year net stock of high-tech capital (that is, the stock of computers and other office machines, communication equipment, and instruments). If high-tech capital is "inherently" more productive than other types, the coefficient on this variable is likely to be positive—in other words, industries with a capital mix more geared toward high-tech equipment will show higher levels of labor productivity.

Table 2 presents the results of this regression for three time periods often considered to have differing aggregate productivity trends: 1949-73, 1974-79, and 1980-89.[13] The constant and industry time trends are not reported. In all three periods the coefficient on the high-tech capital stock term is positive (although it is not statistically significant in the 1980s). This finding implies that a 1 percentage point increase in a manufacturing industry's capital stock in the form of high-tech capital adds more to productivity than does an increase in an alternative asset.

The differential coefficient on high-tech capital appears small relative to that on the overall capital stock—especially in the 1980s. However, given the relatively small size of the high-tech stock, the small differential coefficient disguises a large overall

[10]Equations reported in Charles Steindel, "Industry Productivity and High-Tech Investment," Federal Reserve Bank of New York, Research Paper no. 9202, January 1992, use separate dummy variables for each year (rather than the capacity utilization rate) in order to capture cyclical effects. The coefficients on the capital stock and high-tech capital use variables reported in that paper are very similar to those in this article.

[11]The industries are essentially all those identified by two digits in the Standard Industrial Classification, with the addition of the three-digit motor vehicle industry and other transportation equipment industry.

[12]For estimates of similar equations for the nonmanufacturing sector, together with some further variations for the manufacturing sector, see Steindel, "Industry Productivity."

[13]The methods used to calculate gross output by industry differ between the periods before and after 1977. See Frank de Leeuw, Michael Mohr, and Robert P. Parker, "Gross Product by Industry, 1977-88: A Progress Report on Improving the Estimates," *Survey of Current Business*, vol. 71 (January 1991), pp. 23-38.

Table 2

Factors Explaining Productivity in Manufacturing Industries

	Period	Ratio of Capital to Labor	Ratio of High-Tech Capital to Labor	Capacity Utilization	$\bar{R}^2$
Equation 2.1	1949-73	.224 (.039)	.055 (.021)	.610 (.212)	.823
Equation 2.2	1974-79	.447 (.068)	.086 (.044)	.471 (.406)	.854
Equation 2.3	1980-89	.408 (.050)	.026 (.031)	.745 (.417)	.866

Notes: Standard errors are in parentheses. All data are in logs. Capital stock data are start of year. Constant and industry time trend coefficients are not reported.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

impact. According to equation 2.3, a 1 percent increase in the capital stock in each manufacturing industry would increase productivity by .408 percent if there were no associated change in the high-tech stock. (This result roughly squares with the assumption that this coefficient should be somewhere in the neighborhood of .25.) At the end of the 1980s high-tech capital accounted for about 10 percent of the manufacturing capital stock; in other words, a 10 percent increase in the high-tech capital stock would have increased the overall stock by 1 percent. If a 1 percent increase in the overall capital stock were purely in high-tech forms, the associated increase in productivity would be about .65 percent (1 x .408 + 10 x .026 = .668)—more than 50 percent larger than if the increase were in conventional forms of capital.

The size and statistical significance of the high-tech capital term did shrink in the 1980s. It is possible, however, that compositional effects within high-tech capital need to be taken into account. For example, given the dramatic changes in computers in the 1980s, newly purchased high-tech equipment may have been significantly more productive than older vintages during that decade. Accordingly, Table 3 replaces the high-tech capital stock term of the Table 2 model with a five-year distributed lag on gross investment.[14] Conceptually, this substitution is legitimate because capital stocks are, by construction, weighted sums of current and past investment.[15]

The results show a clear vintage effect: investment in high-tech capital has consistently had a big short-term payoff. These results can be fleshed out in much the same manner as those of Table 2. A 1 percent increase in a manufacturing industry's capital stock in the 1980s would increase productivity by .425 percent if the increase were in conventional forms of capital (equation 3.3). If the increase were in high-tech forms, however, data from the late 1980s suggest that the 1 percent increase in the capital stock of a typical manufacturing industry would be equivalent to roughly a 60 percent increase in its high-tech investment.[16] The initial coefficient on high-tech investment in equation 3.3 is a high .107; this indicates that a 1 percent capital stock increase concentrated in high-tech equipment would, after a one-year lag, raise the industry's productivity by nearly 7 percent (1 x .425 + 60 x .107 = 6.845).

Although equation 3.3 credits high-tech investment with giving a large initial surge to productivity, the results suggest a quick fade after the first year. In fact, the sum of the coefficients on high-tech investment for all years is only .020. In other words, the long-run effect

[14] In a sense these equations assume that the flow of investment is superior to the stock of capital as an indicator of the input of capital. This assumption may seem unusual, but severe changes in the composition of the aggregate capital stock have led some economists to argue that in the absence of direct observations, aggregate investment is likely to dominate standard measures of the gross and net capital stock as a gauge of the aggregate capital input. See Frank de Leeuw, "Interpreting Investment-to-Output Ratios," in Allan Meltzer, ed., *Unit Roots, Investment Measures, and Other Essays*, Carnegie-Rochester Conference Series on Public Policy, vol. 32 (1990), pp. 83-120. A. Steven Englander and Charles Steindel, "Evaluating Recent Trends in

Footnote 14 continued
Capital Formation," this *Quarterly Review*, vol. 14 (Autumn 1989), pp. 7-19, produce evidence against this hypothesis on an aggregate level. Nonetheless, the superiority of investment could well be valid for individual components of the capital stock.

[15] The Commerce Department assumes that high-tech capital has an eight-year life. Given this assumption, a five-year distributed lag on high-tech investment seems ample to pick up any differential productivity effects.

[16] At the end of 1989 the real aggregate net capital stock of the manufacturing sector was $780 billion; the sector's high-tech stock was $82 billion and its gross high-tech investment for the year was $12.5 billion.

Table 3
Vintage Effects of High-Tech Investment on Productivity in Manufacturing Industries

	Period	Ratio of Capital to Labor	Ratio of High-Tech Investment to Labor		Capacity Utilization	$\bar{R}^2$
			Prior Year	Sum over Prior Five Years		
Equation 3.1	1953-73	.184 (.039)	.080 (.041)	.107	.664 (.223)	.850
Equation 3.2	1974-79	.420 (.071)	.120 (.108)	.087	.698 (.512)	.855
Equation 3.3	1980-89	.425 (.051)	.107 (.060)	.020	.977 (.435)	.871

Notes: Standard errors are in parentheses. All data are in logs. Capital stock data are start of year. Constant and industry time trend coefficients are not reported.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

of a 1 percent increase in gross high-tech investment on productivity is an increase of .020 percent, over and above its effect on the overall capital stock. A 1 percent increase in gross high-tech investment, however, will in the long run be associated with a 1 percent increase in the high-tech capital stock. Equation 2.3 shows that the effect of a 1 percent increase in the high-tech capital stock on productivity is a rise of .026 percent. It is reassuring that equation 3.3 has essentially the same long-run properties as equation 2.3. Basically, equation 3.3 gives some of the short-term dynamics missing from 2.3.

Table 4 presents estimates of the gains manufacturing industries made from high-tech capital stock growth in the late 1980s and compares them with the gains made from overall capital formation. The estimates were prepared by calculating, for each manufacturing industry, the percentage increases in overall capital per worker and high-tech capital per worker from 1980-84 to 1985-89, multiplying these percentage changes by the relevant coefficients in equation 2.3, and reporting the average result. Thus, the reported number is an estimate of the productivity gains realized by a typical manufacturing industry over the course of the 1980s from overall capital formation and the incremental effect credited to the high-tech component.

Table 4
Factors Influencing Productivity Growth in Manufacturing Industries in the Second Half of the 1980s
In Percent

Average industry productivity change, 1980-84 to 1985-89	18.7
Influences computed from equation 2.3	
Overall capital growth	3.2
Additional effect of high-tech capital growth	1.7
Changes in capacity utilization	4.0
Other factors†	8.7

†Industry time trends and unexplained statistical error. This figure is calculated as the residual change after accounting for the other influences.

For the typical industry, labor productivity levels were on average 18.7 percent higher in the second half of the 1980s than in the first half. According to equation 2.3, about one-sixth of this increase—3.2 percentage points—was due to an increased ratio of capital to labor.

The high-tech capital and investment effects significantly boost the overall effect of capital. Equation 2.3 suggests that the increase in high-tech capital per worker in the late 1980s contributed an additional 1.7 percentage points to overall labor productivity, over and above its effect on capital stock growth. Thus, the incremental effect of high-tech capital formation on manufacturing industry labor productivity was about one-half the impact of overall capital formation. Summing these two estimates yields the combined effect of overall capital stock growth and high-tech growth; this total accounts for about 25 percent of the increase in labor productivity in a typical manufacturing industry. Cyclical factors as measured by changes in capacity utilization account for a bit less. This reckoning still

Table 5
Effects of Machinery Stocks on Productivity in Manufacturing Industries, 1980-89

	Ratio of High-Tech Machinery to Labor	Ratio of Standard Machinery to Labor	Ratio of All Machinery to Labor	$\bar{R}^2$
Equation 5.1	.026 (.031)			.866
Equation 5.2		−.085 (.095)		.870
Equation 5.3	.014 (.126)	−.057 (.041)		.870
Equation 5.4			−.191 (.121)	.872

Notes: Standard errors are in parentheses. All data are in logs. Capital stock, capacity utilization, constant and industry time trend coefficients are not reported. "Standard" machinery is metalworking, general industrial, and special industry machinery. "All machinery" is the sum of standard and high-tech machinery.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

leaves a very large portion of the increase in productivity unexplained except in a purely statistical way by time trends. Hence, much of the acceleration in output per worker remains a mystery. In any event, these results suggest that the role of high-tech capital growth in manufacturing industry productivity trends in the 1980s was economically significant and substantial in comparison with that of capital formation in general.[17]

These results do not detail how increased manufacturing investment in high-tech equipment increased productivity. It may be that intensified foreign competition encouraged manufacturers to seek economies, and computerization of back-office operations was a relatively simple way to reduce expenditures. Alternatively, common reports that manufacturers profited from breakthroughs in the use of computer-managed design and control of production may be correct.[18]

Since high-tech equipment is still a relatively small part of the overall manufacturing capital stock, it is conceivable that the calculated relationship between productivity and high-tech capital could be merely a proxy for a relationship between productivity and some larger category of capital—for example, traditional forms of machinery. It is possible that in the 1980s the productivity of traditional machinery was higher than that of capital in general, as a result of improvements in technology that were also associated with increased spending on high-tech equipment. Table 5 summarizes a number of regressions, similar in structure to those of Table 2, relating productivity to capital holdings in high-tech and more traditional types of manufacturing machinery—the sum of metalworking, general industrial, and special industry machinery. The table reports only the individual coefficients for machinery types. As in Table 2, a positive coefficient suggests that the machinery type is more productive than overall capital. There is no evidence that traditional machinery contributed more to productivity in the 1980s than did capital in general.[19]

Conclusions

Growth in the stock of high-tech equipment appears to have played a meaningful role in the recent acceleration in manufacturing productivity growth. This conclusion is in contrast to the more skeptical assessment offered by the standard neoclassical analysis. The results suggest that the neoclassical assumption that financial returns and asset prices provide accurate information about the productivity of capital may not be valid for high-tech investment by all industries.

The statistical analysis of this article indicates that about one-sixth of the growth in productivity in a typical manufacturing industry over the second half of the 1980s may be attributed to growth in its capital stock, and an additional one-tenth to growth in the industry's stock of high-tech capital. Because of the imprecise estimate of the productivity impact of high-tech capital in equation 2.3, the attribution to high-tech capital is subject to a considerable margin of error. Nevertheless, the results in Table 3 suggest that even if the cumulative impact of high-tech capital formation is small, the initial effect of increased investment in the area may be substantial.

On the whole, it appears that overall capital formation, including the differential impact of the high-tech component, accounted for about 25 percent of productivity growth in manufacturing industries in the late 1980s. The cyclical improvement in the economy from the first to the second half of the decade, as gauged by increased capacity utilization, was apparently associated with a slightly smaller share of the increase. The remainder of productivity growth—about one-half the total—was probably associated with the normal growth of technology as well as extraordinary factors such as the drop in energy prices and moves to improve efficiency in the face of foreign competition.

The evidence produced in this article does not show that high technology was a decisive element in the improvement in manufacturing productivity in the 1980s. Nevertheless, the results suggest that high-tech equipment may have made a larger contribution than the traditional analysis implies.

[17] A similar calculation for equation 3.3 results in an estimated contribution of high-tech investment to productivity equal to zero for a typical manufacturing industry in the second half of the 1980s. This result is due to modest declines in high-tech investment by manufacturers in the late 1980s; the calculation indicates that high-tech investment made its greatest contribution to productivity levels in the middle years of the decade.

[18] In "Pitfalls on the New Assembly Line" Roach argues that computers aided back-office economies in manufacturing. Others have advanced different explanations for the surge in manufacturing productivity. For instance, a recent study suggests that manufacturers that implemented new training programs in the 1980s saw unusually rapid productivity gains. See Ann P. Bartel, "Productivity Gains from the Implementation of Employee Training Programs," National Bureau of Economic Research, Working Paper no. 3893, November 1991.

[19] When these equations were estimated with the same specification as those of Table 3, vintage effects were evident for traditional as well as high-tech machinery. This finding is consistent with the results obtained for an international cross section in J. Bradford De Long and Lawrence H. Summers, "Equipment Investment and Economic Growth," *Quarterly Journal of Economics*, vol. 106 (May 1991), pp. 445-502; and De Long, "Productivity and Machinery Investment: A Long-Run Look, 1870-1970," National Bureau of Economic Research, Working Paper no. 3903, November 1991.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Treasury and Federal Reserve Foreign Exchange Operations

February-April 1992

The dollar advanced against all major foreign currencies during the February to April period as an improved outlook for the U.S. recovery contrasted with evidence of economic and financial fragility abroad. The dollar's rise was most pronounced against the mark and other European currencies early in the period. By late February, however, the dollar had leveled off against the mark, and the focus of market attention shifted to the yen. During late March and April, the dollar largely consolidated its gains, trading in a relatively narrow range against both currencies. On balance, the dollar gained 2¼ percent against the German mark, 6 percent against the Japanese yen, and 2¼ percent on a trade-weighted basis as measured by the staff of the Federal Reserve Board.

Shifts in short-term interest rate differentials reflecting relative economic and financial conditions in the major industrial countries supported the dollar against the yen but weighed on it against the mark. In the United States, most short-term interest rates rose slightly in February and March as U.S. economic reports encouraged a more optimistic view of the strength of the U.S. recovery and then eased modestly during April to end the period 10 to 15 basis points below their opening levels. Meanwhile, short-term interest rates in Japan declined by 50 basis points over the period amid evidence of weakening domestic demand and turbulence in Japanese stock and bond markets. In Germany, short-term interest rates over the period edged up by almost 40 basis points as government borrowing remained strong and market concerns about inflationary pressures failed to diminish. As a result, the interest rate gap favoring foreign short-term investments over their U.S. counterparts tended to narrow with Japan and widen with Germany.

A report presented by William J. McDonough, Executive Vice President in charge of the Foreign Group at the Federal Reserve Bank of New York and Manager of Foreign Operations for the System Open Market Account. Vivek Moorthy was primarily responsible for preparation of the report.

February to mid-March

The dollar's strong rise during the first half of the reporting period reflected an emerging sense of optimism among market participants about the U.S. economy. At the outset, sentiment toward the economy was far from upbeat. Market participants were concerned about the failure of the recovery to spur significant job growth and about the ongoing weakness in consumer and business confidence. Indeed, the dollar opened the period with a soft tone, touching period lows of DM 1.5570 and ¥124.70 following the release of a much weaker than expected January employment report on February 7.

Anxiety about the U.S. recovery, however, soon gave way to the view that the economy was strengthening. In mid-February, the release of two sets of highly favorable economic reports covering the month of January, one on retail sales and the other on housing starts, led to a rapid run-up of the dollar. Then in early March a series of positive reports, beginning with the February survey of purchasing managers, pushed the dollar up to levels not seen since the fall of 1991.

Statements by U.S. officials around this time reinforced the market's more positive outlook towards the U.S. economy and spurred the view that further monetary easing was unlikely in the near term. Market partic-

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

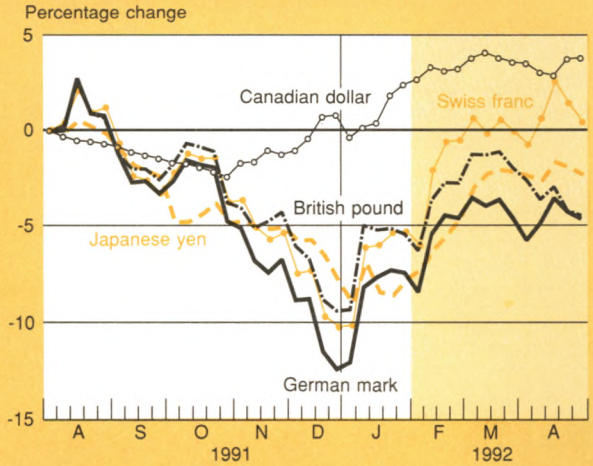
ipants paid particular attention to statements by the Federal Reserve Chairman suggesting that monetary easing already in the pipeline was adequate. As the outlook for the U.S. economy improved, short-term interest rates began to back up, and the narrowing of unfavorable interest rate differentials helped underpin the dollar.

The dollar's rise was most pronounced against the mark and other European currencies early in the period, although its advance against the yen continued longer and was ultimately of greater magnitude. The different behavior of the dollar against these two currencies in early to mid-February reflected both special factors affecting Germany and Japan and market expectations that the authorities might intervene in the currency markets to strengthen the yen.

In early February, the market's view that German interest rates had peaked and might begin to decline as early as midyear helped support the dollar against the mark and other European currencies. This view was based on two assumptions. Market operatives believed that the strong reaction both within Germany and throughout Europe to the Bundesbank's move to tighten monetary policy in December 1991 would discourage further tightening for some time. Meanwhile, growing evidence of a German economic downturn appeared to make additional policy action unnecessary.

Chart 1

The dollar continued to rise against most currencies in the early part of the period and subsequently traded in a narrow range.



Notes: The chart shows the percentage change of weekly average rates for the dollar from August 1, 1991. All figures are calculated from New York closing rates.

As February progressed, however, several developments led market participants to reconsider the view that the German authorities would soon move to lower interest rates. These included reports showing a pickup in money supply growth and inflation in January as well as signs that wage negotiations in Germany in 1992 would result in settlements larger than those anticipated earlier. In this environment, market participants first pushed the date of expected policy easing farther into the future and then began to anticipate the possibility of additional tightening. As a result, the dollar leveled off against the mark at about DM 1.65.

The prospect of continued tight German monetary policy was seen in the market as having implications for other European currencies as well. With respect to the Swiss franc, the Swiss authorities had chosen, in late 1991, not to take part in the German-led tightening of monetary policies in Europe in order to avoid aggravating Switzerland's year-long recession. During January, the franc managed to remain stable against the mark. But in mid-February, when expectations for an early ease in Germany monetary policy waned, the Swiss franc began a sharp decline against the mark, prompting heavy intervention by the Swiss authorities and an eventual rise in Swiss interest rates that exceeded any comparable rise in German rates. The experience of the Swiss franc revealed to market participants the risks facing the authorities in other European countries experiencing weak growth, such as the United Kingdom, if they eased policy without a corresponding move in Germany.

Many of the factors that boosted the dollar against the European currencies were also operative in the market for the yen. Evidence of a pronounced slowdown in the Japanese economy mounted. From early to late February, interest rate differentials against the yen, although adverse to the dollar, narrowed considerably and did so to a greater extent than against the mark. Nevertheless, in February the dollar firmed less strongly against the yen than against the mark.

The dollar's tendency in February to appreciate less against the yen than against the mark in part reflected expectations of official intervention to support the yen. At the time, Japanese officials were making increasingly strong and frequent statements indicating that they would not tolerate an excessive yen decline. In the event, the Desk entered the Tokyo market on February 17, in cooperation with the Japanese authorities, to sell a total of $100 million against yen. This operation was followed on February 20 with the sale, again in Tokyo, of an additional $50 million against yen. The February 17 operation was financed by the U.S. Treasury. The February 20 operation was financed equally by the U.S. Treasury and the Federal Reserve.

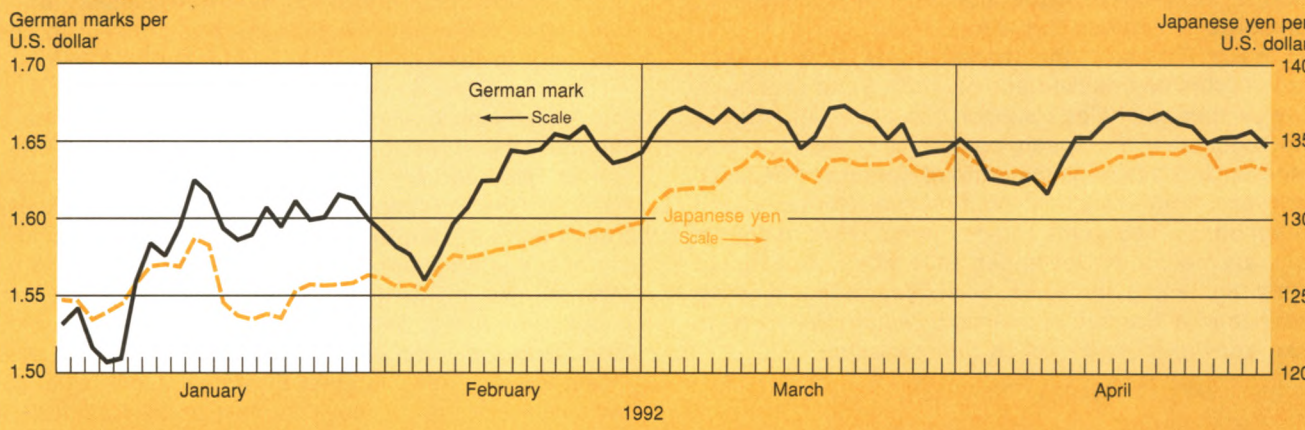
Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

By late February, the dollar's relative movements against the mark and the yen reversed. Having stabilized against the mark, the dollar continued to gain against the yen amid increasing signs of fragility in the Japanese economy and financial system and worries over the potential political ramifications of ongoing financial scandals. Concerns about the Japanese economy were reflected in an additional decline in Japanese short-term rates in late February and March, which served to further reduce interest differentials unfavorable to the dollar.

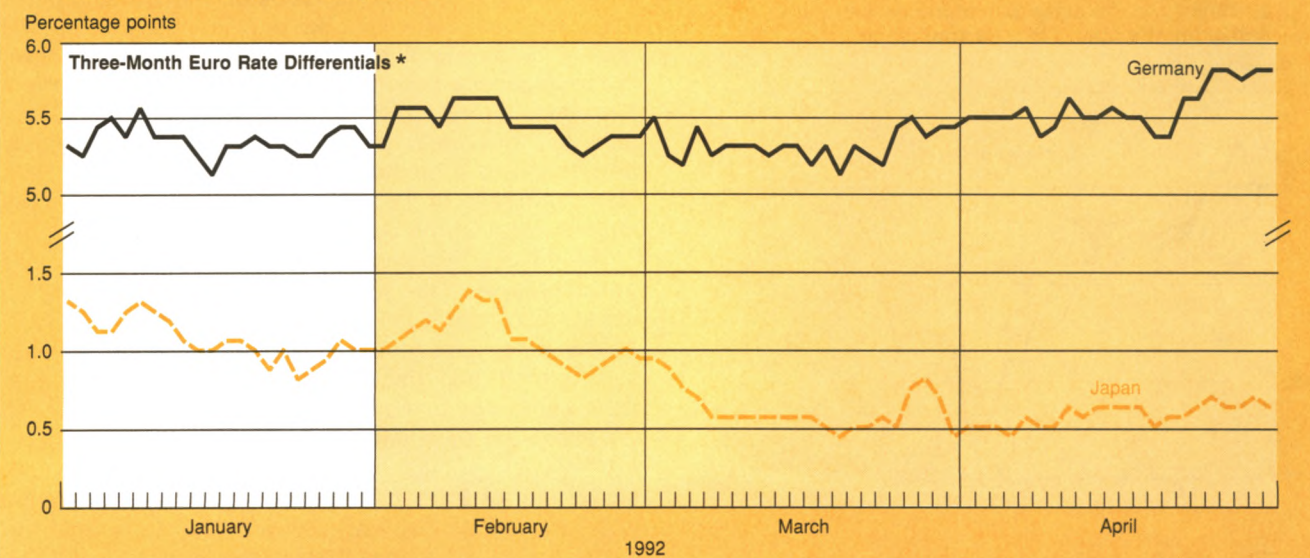
At the same time, market participants concluded that the growing negative sentiment towards the Japanese currency would not be reversed by intervention that was not perceived as concerted and sustained. Thus, they increasingly shrugged off the possibility of intervention. In this environment, the dollar continued the steady advance against the yen that had begun in early Janu-

Chart 2

The dollar rose more sharply against the mark in February but continued to rise against the yen through mid-March.



Interest rates moved in favor of the mark in late March and April, while interest rates moved against the yen in February and early March.



Note: Values shown in top panel are closing daily rates.

* Foreign rate minus U.S. rate.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

ary, rising to levels around ¥134 by mid-March.

Mid-March through April

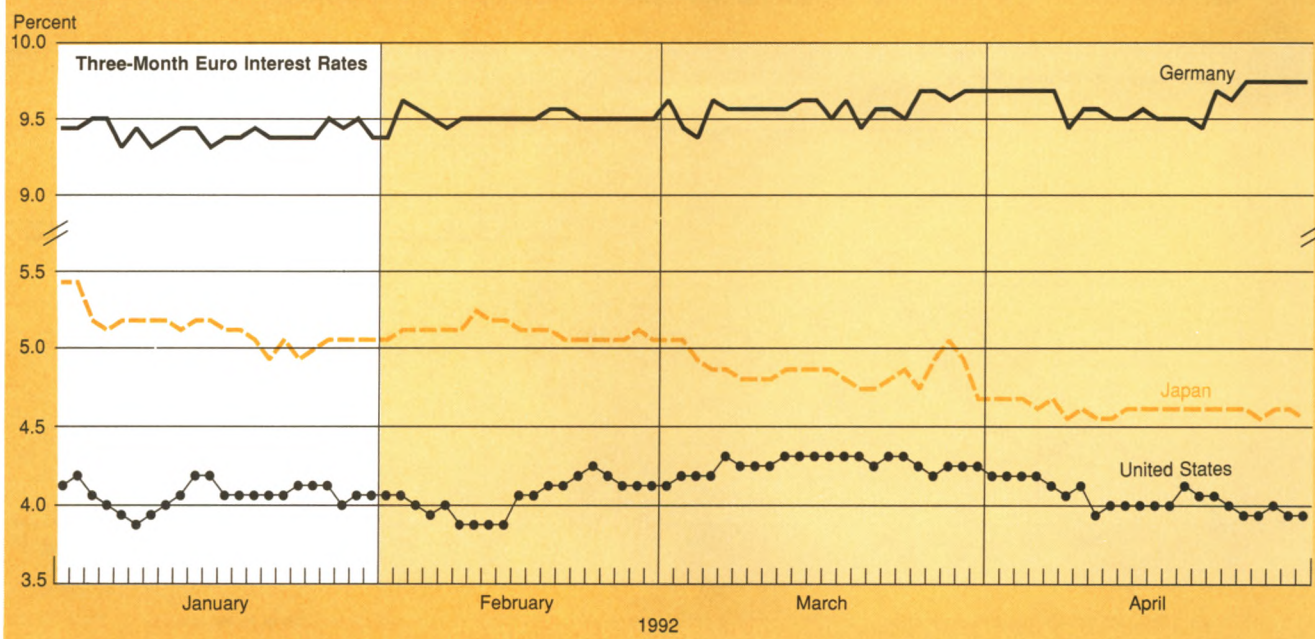
After mid-March, the dollar traded in relatively narrow ranges against the mark and the yen. The absence of clear direction in dollar exchange rates reflected several offsetting trends. On the one hand, reports on the U.S. economy reinforced the view that the recovery would remain weak by historical standards and thus offered little to justify a further dollar appreciation. On the other hand, governments abroad appeared increasingly preoccupied with domestic difficulties, a situation interpreted by market participants as precluding joint official action to bring the dollar lower. With dollar markets relatively lackluster through April, position takers tended to focus on movements of the European currencies against one another, particularly the British pound and Swiss franc relative to the mark.

Market sentiment toward the U.S. economy underwent a subtle shift in March and April. Although data generally reinforced the earlier view that a recovery was under way, market participants tended to focus less on the fact of recovery and more on its strength. Many questioned whether the recovery would be vigorous enough to warrant a reversal in the long-term downtrend in U.S. interest rates. Moreover, many of the economic reports that appeared favorable on the surface were attributed to special factors. For instance, the increase in February payrolls, though significantly higher than expected, was largely discounted on the grounds that a big increase in retail jobs may have partially reflected problems in seasonal adjustment. Subsequent favorable data on retail sales, housing starts, and home sales were similarly attributed to onetime factors. Thus market participants were generally reluctant to push the dollar up further. Only when tensions mounted between the United Nations inspection team and Iraq over Iraq's nuclear weapons program did the dollar move above DM 1.68, the perceived top of its trading range, to reach its period high against the mark of DM 1.6860 on March 20. The dollar reached its period high against the yen of ¥134.97 on April 2.

By early April, doubts about the strength of the U.S. recovery intensified. The March employment report released on April 3 showed a small decline in private nonfarm payrolls. Meanwhile, the M2 measure of money supply, having risen sharply earlier in the year, fell toward the lower end of its target range, a decline that elicited expressions of concern by several U.S. officials. On April 9, the Federal Reserve relaxed reserve pres-

Chart 3

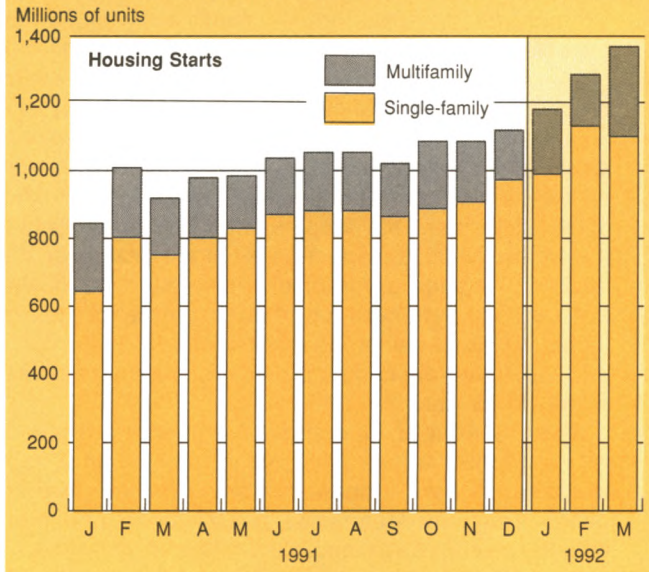
Japanese interest rates declined throughout the period, while German interest rates rose towards the end. U.S. rates firmed in early March but then reversed course.

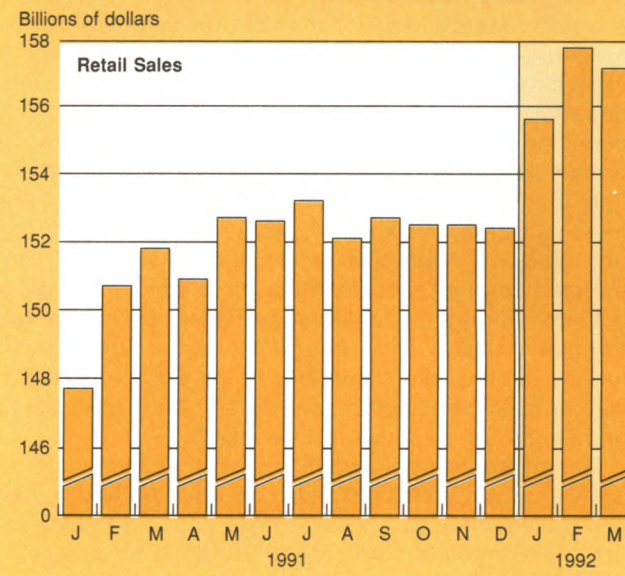


Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Chart 4

Housing starts and retail sales data released during February suggested that the recovery was proceeding apace.

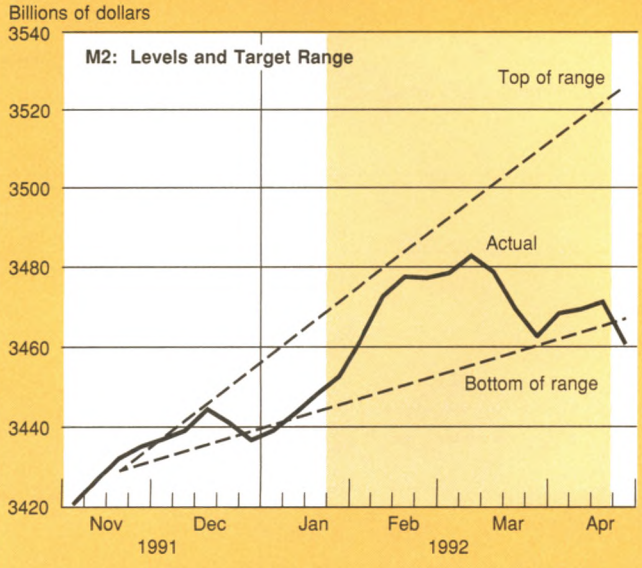


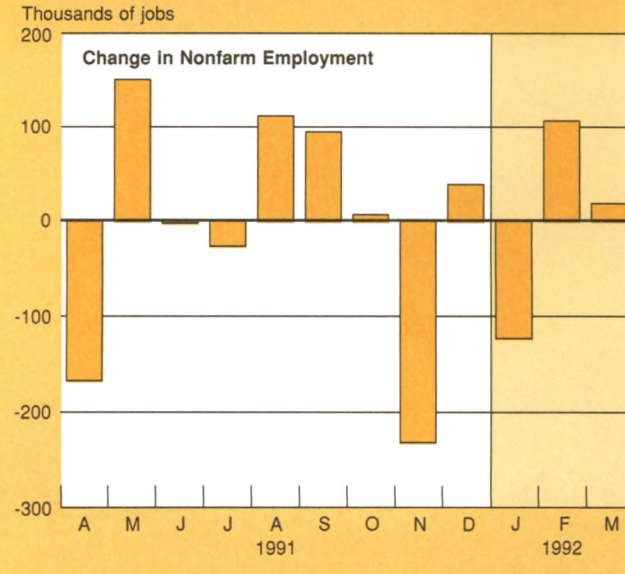


Note: Data are as of end-April. The retail sales figures were released on February 13, March 12, and April 14, while the housing starts data were released on February 19, March 17, and April 17, respectively.

Chart 5

Data released during April indicated substantial weakness in money supply and employment.





Notes: Data for the left panel are as of May 15, 1992. In this panel, the target range for 1992 starts in the middle of November 1991. Data for the right panel are as of April 3, 1992.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

sures to an extent consistent with about a ¼ percentage point reduction in the federal funds rate. In this environment, other U.S. short-term interest rates declined, interest rate differentials moved against the dollar to varying degrees, and the dollar eased. Although the dollar received temporary support from favorable data in mid-April, most notably a sharp reduction in the February merchandise trade deficit, on balance the dollar was unchanged against the mark during April.

During the latter half of April, the mark received support from a rise in German short-term interest rates, a rise that helped further widen the already substantial advantage accruing to short-term mark investments. The rise in German rates occurred as the Bundesbank issued warnings about the inflationary threat of rapid money supply growth and high wage settlements and as its operations served to lift rates on domestic securities repurchase agreements. Indeed, inflationary concerns were reinforced during April by German public sector employees' call to strike and by an unexpected acceleration of M3 money supply growth from 8.6 percent in February to 9.4 percent in March—a rate well above the upper end of the Bundesbank's target range for M3 growth of 5.5 percent.

Meanwhile, the British pound came under pressure within the Exchange Rate Mechanism (ERM) of the European Monetary System in response both to concerns over elections in the United Kingdom scheduled for April 9 and to the rise in German interest rates. Market participants expressed concern that the British election would not result in a clear mandate for any party or that a new government might not be committed to sterling's current parity within the ERM. Despite the protracted weakness of the U.K. economy in the months leading up to the election, the strong downward pressure, coupled with sterling's position near its lower intervention limit in the ERM, precluded any easing of monetary policy. In the end, sterling rose strongly following news of the Conservative party's April 9 election victory. Financial markets also rallied, with a key stock market index gaining about 6 percent after the results were announced.

The dollar remained remarkably stable against the yen during mid-March and April despite evidence of continuing weakness in the Japanese economy and mounting financial woes. This stability occurred against a backdrop of relatively steady short-term interest rate differentials, with short-term rates in both the United States and Japan declining by roughly the same amount. The decline in Japanese rates occurred throughout the period, both in anticipation of and in further reaction to the 75 basis point Japanese discount rate cut on April 1.

The decline in Japanese stock prices appeared to have largely offsetting influences on the dollar-yen exchange rate. On the one hand, weakness in the stock market was seen both as increasing the prospects for

Table 1
Federal Reserve Reciprocal Currency Arrangements
In Millions of Dollars

Institution	Amount of Facility April 30, 1992
Austrian National Bank	250
National Bank of Belgium	1,000
Bank of Canada	2,000
National Bank of Denmark	250
Bank of England	3,000
Bank of France	2,000
Deutsche Bundesbank	6,000
Bank of Italy	3,000
Bank of Japan	5,000
Bank of Mexico	700
Netherlands Bank	500
Bank of Norway	250
Bank of Sweden	300
Swiss National Bank	4,000
Bank for International Settlements	
Dollars against Swiss francs	600
Dollars against other authorized European currencies	1,250
Total	30,100

Table 2
Drawings and Repayments by Foreign Central Banks under Special Swap Arrangements with the U.S. Treasury
In Millions of Dollars; Drawings (+) or Repayments (−)

Central Bank Drawing on the U.S. Treasury	Amount of Facility	Outstanding as of January 31, 1992	February	March	April	Outstanding as of April 30, 1992
National Bank of Panama	143.0†	143.0	−85.0	−58.0	—	—

Note: Data are on a value-date basis. Components may not add to totals because of rounding.
†Represents a bilateral credit facility with the National Bank of Panama that was established on January 28 and repaid in full on March 11.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Table 3
Net Profits and Losses on United States Treasury and Federal Reserve Foreign Exchange Operations
In Millions of Dollars; Profits (+) or Losses (−)

	Federal Reserve	U.S. Treasury Exchange Stabilization Fund
Valuation profits and losses on outstanding assets and liabilities as of January 31, 1992	+3,615.2	+1,941.6
Realized February 1-April 30, 1992	0.0	0.0
Valuation profits and losses on outstanding assets and liabilities as of April 30, 1992	+2,653.1	+1,039.5

Note: Data are on a value-date basis.

further easing in Japan and as discouraging continued investment from abroad. On the other hand, market participants believed that Japanese institutions were repatriating funds from abroad to bolster bank capital ratios and that these capital inflows were providing support for Japanese currency. Subsequently released data indicated that Japanese residents were indeed large net sellers of foreign securities in March, resulting in an increase in net inflows to Japan.

Toward the end of the month, the possibility of official action to support the yen again became a focus of market attention with the approach of the Group of Seven (G-7) meeting in Washington in the last week of April. G-7 finance ministers and central bank governors issued a statement on April 26 noting that "the decline of the yen since their last meeting was not contributing to the adjustment process." Against the backdrop of this statement and subsequent comments by both U.S. and Japanese officials, the dollar declined from the higher end to the lower end of the ¥132 to ¥135 range in which it had traded for most of April.

* * *

In other operations, the U.S. Treasury Exchange Stabilization Fund (ESF) repurchased the remaining $2 billion equivalent of foreign currencies that it had warehoused with the Federal Reserve. The ESF also received repayment in full from Panama on a $143 million special swap facility initiated in late January. As of end-April, the U.S. monetary authorities had no forward transactions outstanding.

As of the end of April, cumulative bookkeeping or valuation gains on outstanding foreign currency balances were $2,653.1 million for the Federal Reserve and $1,039.5 million for the ESF. There were no realized profits or losses during the period. The Federal Reserve and the ESF regularly invest their foreign currency balances in a variety of instruments that yield market-related rates of return and that have a high degree of quality and liquidity. A portion of the balances is invested in securities issued by foreign governments. As of the end of April, the Federal Reserve's holdings of these securities totaled $8,776.8 million equivalent and the Treasury's holdings totaled $8,852.7 million equivalent, valued at end-of-period exchange rates.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

RECENT FRBNY UNPUBLISHED RESEARCH PAPERS†

9204. Johnson, Ronald. "Price-Adjustment Delays in the Secondary Market for Developing Country Debt and the Estimation of Asset Pricing Models." With Umran Demirors. February 1992.

9205. Park, Sangkyun. "Loan Contraction within a Framework of Moral Hazard." March 1992.

9206. Korobow, Leon, and David P. Stuhr. "Financial Leverage versus Return on Book Equity at Bank Holding Companies in 1988, 1986, 1980." March 1992.

9207. Mosser, Patricia C. "Large Model Comparisons of Monetary Policy Sensitivity." April 1992.

9208. Hardouvelis, Gikas A. "The Term Structure Spread and Future Changes in Long and Short Rates: Is There a Puzzle?" April 1992.

9209. Rodrigues, Anthony P. "Tests of Mean-Variance Efficiency of International Equity Markets." April 1992. With Charles M. Engel.

9210. Klitgaard, Thomas. "U.S. Imports in the 1980s: Some Insights from a Disaggregate Analysis." April 1992.

9211. Boldin, Michael. "Using Switching Models to Study Business Cycle Asymmetries: 1. Overview of Methodology and Application." June 1992.

9212. Uctum, Merih. "Money Markets and Common Monetary Policy in France, Germany, and Italy." July 1992.

9213. Clarida, Richard H. "Cointegration, Aggregate Consumption, and the Demand for Imports: A Structural Econometric Investigation." August 1992.

9214. Clarida, Richard H. "The Real Exchange Rate and U.S. Manufacturing Profits: A Theoretical Framework with Some Empirical Support." August 1992.

†Single copies of these papers are available upon request. Write Research Papers, Room 901, Research Function, Federal Reserve Bank of New York, 33 Liberty Street, New York, N.Y. 10045.

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Single-copy subscriptions to the *Quarterly Review* (ISSN 0147-6580) are free. Multiple copies are available for an annual cost of $12 for each additional subscription. Checks should be made payable in U.S. dollars to the Federal Reserve Bank of New York and sent to the Public Information Department, 33 Liberty Street, New York, N.Y. 10045-0001 (212-720-6134). Single and multiple copies for U.S. subscribers are sent via third- and fourth-class mail. Subscriptions to foreign countries, with the exception of Canada, are mailed through the U.S. Postal Service's International Surface Airlift program (ISAL) from John F. Kennedy International Airport, Jamaica, New York. Copies to Canadian subscribers are handled through the Canadian Post.

Quarterly Review subscribers also receive the Bank's Annual Report.

Quarterly Review articles may be reproduced for educational or training purposes, providing they are reprinted in full and include credit to the author, the publication, and the Bank.

Library of Congress Card Number: 77-646559

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis

Federal Reserve Bank of New York
33 Liberty Street
New York, N.Y. 10045-0001

Return Postage Guaranteed

Digitized for FRASER
http://fraser.stlouisfed.org/
Federal Reserve Bank of St. Louis