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Quarterly Review

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Balancing Progressive Change and Caution in Reforming the Financial System

Good morning, Mr. Chairman and members of the Committee. I am delighted to have this opportunity to appear before you to discuss again certain aspects of the ongoing efforts to reform and modernize the banking and financial system of the United States. In discussing these issues with you, I have, in words that Yogi Berra is alleged to have uttered, a sense of "déjà vu all over again." What I mean by that, of course, is that we have been discussing these issues for years. But now the time has come to act—a sentiment that I know is widely shared among the members of this Committee.

You have asked me, Mr. Chairman, to respond to a number of questions on the banking and commerce issue. While those questions are covered in the opening section of this statement, I have also included a number of observations on other aspects of the reform process as a whole, many of which bear on issues I have discussed with this Committee on earlier occasions.

In considering the specific question of banking and commerce as well as the larger question of reform of the banking system, it seems clear to me that the Congress is faced with a very difficult dilemma. On the one hand, the need for progressive reform is urgent, to put it mildly. On the other, the need for caution is equally strong, since so very much is at stake not only for the well-being of our financial system over time but also for the health and vitality of the economy at large. Striking the proper balance between progressive change and caution is not easy, but that goal is within

reach. I might note at the outset that in my judgment permitting commercial firms to control banks fails on both counts. It is neither progressive nor cautious.

Banking and commerce

As the Committee knows, several weeks ago I appeared before the House Subcommittee on Telecommunications and Finance to discuss the banking-commerce question. At that time I submitted a rather lengthy statement. While I am sensitive to the appearance of placing before this Committee what may be viewed as a rerun, I have attached to this statement that earlier testimony. Even without the benefit of that lengthy statement, it will, I am sure, come as no surprise to you when I repeat my strong opposition to arrangements that would permit commercial firms to control banking institutions.

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While that opposition is steadfast in current circumstances, I also have said on many occasions—including before this Committee—that I am not opposed to providing a measure of greater flexibility in this area so long as the protections against control are not violated or threatened. In addition, I believe the basic ground rules associated with passive investments in banking institutions are badly in need of clarification. In part,

this need for clarification arises because the proliferation of new capital market instruments has made it very difficult to administer the existing rules in a setting in which there is a large grey area between investments of less than 5 percent, where control is presumed not to exist, and investments of 25 percent or more, where control is presumed to exist. Of course, if such clarifica-

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tions are made regarding passive investments in banking organizations, logic would suggest that the same ground rules should govern passive investments by bank holding companies in firms whose scope of activities falls outside the "closely related" test in the Bank Holding Company Act.

With that suggestion in mind, let me now turn to the specific questions posed by the Committee regarding controlling investments in banking institutions by commercial firms.

1. Would allowing commercial firms to acquire and control banks bolster the capital base of the banking industry?

The answer to this question is unclear. Whether or not the capital base of the banking industry would be increased depends on a number of factors, including the nature of the investments, their size, how they are financed and, very important, whether the "added" capital results from double-leveraging the existing capital base of the commercial firms making the investments. To the extent the latter is the case, the "increase" in the capital base in banking could, over time, prove to be illusory.

In important respects, however, the question whether the capital base in banking would be increased is the wrong question. Capital is attracted by profits. If the returns are not there, capital will not and should not flow to a firm or an industry. On the other hand, if the returns are there, capital will flow quite naturally. That is why it is so important to enact legislation that would remove the

artificial barriers impeding the profitability of banking. In that environment, I am quite sure that sufficient capital will flow to the banking industry from traditional sources.

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Finally, it is by no means clear to me that the banking *system* does not have, or have access to, adequate capital from traditional sources. Indeed, given the obvious "overbanking" problem in this country, a good case can be made that part of the problem in banking and finance may well be that we have too much capital chasing too few *good* loans.

2. What impact, if any, would allowing commercial firms to control banks have on our nation's monetary policy?

If commercial ownership of banking organizations becomes widespread, there is a danger that the resulting concentration of economic—and perhaps

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even political—power could have subtle but serious implications for monetary policy. This would be true even though it is highly unlikely that such arrangements could, by themselves, undermine the technical linkages between monetary policy and the economy. That is, as a purely technical matter, there is some set of credit market conditions and interest rates that could be achieved by the monetary authorities that would, for example, check inflationary pressures in the economy. However, in an environment in which there is widespread control of banks by commercial firms, achieving that result could be more costly to the society at large. That possibility arises for two reasons.

First, if commercial firms controlled banks on a wide scale, the resulting economic power base might undermine the nation's will to resist short-run

temptations to live with a "little more" inflation. Since a central bank can only be independent *within* the government and the society it serves, these pressures could—in very subtle but insidious ways—undermine the capacity of the central bank to perform its necessary task of promoting long-

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term goals relating to price stability, financial stability, and overall economic stability.

Second, if commercial ownership of banks resulted in a further increase in overall leverage—and especially double leverage—the fragility of both the financial and the nonfinancial sectors could increase further. In turn, that result could either (1) produce a situation in which the monetary authorities might, in the short run, feel compelled to be more tolerant of financial excesses or (2) produce a situation in which both the financial system and the economy at large are more prone to disruptions and instability. In fact, the first of these dangers would surely give rise to the second. In that

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eventuality, the ultimate costs of checking these excesses—costs which could not be avoided forever—could be very great indeed.

3. Would allowing commercial firms to control banks necessarily create new risks for the Bank Insurance Fund administered by the FDIC and for taxpayers who stand behind that Fund?

There is no question that such risks would increase, just as there is no question that the risks of the extension of the safety net more generally to the commercial owners of banks would increase. Reasonable men and women can debate the extent to which such risks might increase, but there is no doubt in my mind as to the direction of change.

One compelling reason that such risks would increase is that there is no system of firewalls that is failsafe. Indeed, as outlined in my House statement in greater detail, the so-called contagion effects associated with problems in one part of a family of institutions simply cannot be safely isolated from the family as a whole. Experience has shown this to be the case time after time. When we need them the most, firewalls simply will not work.

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4. Do you think there is any validity to concerns, expressed by some, that allowing banking and commercial firms to combine would lead to an unhealthy concentration of economic power in this country?

Yes, these concerns are entirely valid. In this connection, it is important to keep in mind that the nature of those risks is such that there is no middle ground on the banking-commerce issue. That is, there are some who would ask why commercial firms should not be allowed to own selected banks. Or, why not allow commercial firms to own only troubled or failing banks? Implicit in these questions is the suggestion that we can have it both ways. That is, we can satisfy the desires of a few companies or a few banks, we can paper over some problems, and we can duck hard choices, while at the same time avoiding the concentration or other problems associated with commercial control of banks. I just do not see it that way. This is a very slippery slope and if we as a nation start down that slope we will, at that very instant, set in motion forces that will be very difficult and very costly to reverse.

5. Would allowing banking and commercial firms to combine necessarily undermine the arm's length relationship that now exists between banks and their creditors and weaken the cornerstone of effective banking, that is, independent credit decisions based on effective evaluations of creditworthiness?

"Necessarily" is a very strong word, but if the question were restated in terms of the *risks* to the impartiality of the credit decision-making process, the answer is clear. Yes, those risks would

increase. The extent of the increase would, of course, depend upon how far and how fast a pattern of commercial ownership of banks might take hold. But even if the risks are perceived as relatively small, the costs could be very high.

6. Would a commercial firm that owns a bank be more apt to make its bank's credits available to its customers rather than to customers of its competitors?

Again, those risks would be present. In fact, these risks exist in virtually every facet of banking even without commercial ownership. With commercial ownership of banks, those risks would rise appreciably. On the other hand, as long as banking markets are truly competitive and as long as appro-

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priate supervisory policies are in place, these risks are manageable. However, keeping them manageable in a context of commercial ownership of banks would be another story, especially given all the other problems that would arise in those circumstances.

To summarize, the risks associated with commercial ownership and control of banks are considerable. In my view, we as a nation should be prepared to run those risks only if there is some compelling public policy reason that dictates that course of action. I see nothing on the horizon that would qualify as that compelling public policy case for permitting such combinations. Thus, unless something changes radically, I remain steadfast in my opposition to commercial ownership or control of banking institutions.

Progressive but cautious reform
While combining banking and commerce does not meet the test of either progressive or cautious change, there are proposals before this Committee and the Congress that in my judgment would pass both of these tests. There are also pressing needs—such as the recapitalization of the bank insurance fund—that must be attended to promptly. As I see it, however, it would be a grave mistake were the Congress only to enact legislation to deal with the financial needs of the Bank Insurance Fund, even if such legislation also included an appropriate title on "progressive supervision" and

"early intervention." The Congress must recognize that the realities of the marketplace, including changing technology, are such that the current configuration of the banking and financial system in the United States is entirely too accident prone—a condition that ultimately threatens the capacity of the system to perform its vital economic tasks. Moreover, it is badly out of line with emerging trends throughout the world—to the continuing detriment of the international competitiveness of U.S. institutions and markets.

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Whether we like it or not, we are going to see an important degree of consolidation in the U.S. banking and financial system. That result, as I am prone to say, is already baked in the cake. The question, therefore, is not whether that process of consolidation will occur, but rather whether it will occur the hard way or the easy way and whether it will occur in a manner that is consistent with the public interest. Narrow legislation, in my view, virtually assures that we will be back in this room two or three or five years from now pasting together another damage control package in circumstances in which the task will be all the more difficult and the public interest all the more at risk.

When I speak of the inevitability of an important degree of consolidation in banking and finance, I do not mean to imply that we in the United States will end up with a highly concentrated banking and financial system such as we see in many other countries. I simply do not see that occurring here. Indeed, I would be vigorously opposed to such an outcome. Even putting aside regu-

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latory restraints and antitrust laws, the realities of banking markets and relationships in this country are such that we will continue to have thousands—but not as many thousands—of banking and financial institutions. Moreover, I am absolutely certain that legions of inde-

pendent community banks will survive and thrive in this otherwise changing environment.

Against this background it seems clear to me that striking the right balance between the dictates of progressive and cautious change requires—indeed demands—more than patchwork legislation. Yes, the Bank Insurance Fund must be recapitalized, and yes, there may be still unexplored ways to produce that result in a manner that minimizes adverse implications for the competitiveness of U.S. banks. Yes, a flexible system of "progressive supervision" and "early intervention," with the qualifications suggested by Chairman Greenspan in his April 23 testimony, should be enacted. Yes, a *very* careful and deliberate approach to deposit insurance reform can help.

But these changes, as necessary and as important as they are, are not sufficient because they do not get to the heart of the structural, competitive, and technological factors that are driving so many of the changes and problems we see in the banking and financial system. That is why any legislation that would meet my personal standard of progressive change would also have to get at these basic structural problems and thus include—*at*

Any legislation that would meet my personal standard of progressive change would also have to get at these basic structural problems and thus include—*at a minimum*—the effective repeal of McFadden, Douglas, and Glass-Steagall.

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I recognize that some would suggest that, in the name of progressive change, I am throwing caution to the wind in taking that position. I also recognize that against the history of the savings and loan mess, even a hint of throwing caution to the wind takes on special significance to the Congress and the American taxpayer. Allow me, therefore, to make several points that I believe will suggest that these structural changes can be made in a manner consistent with the need for caution.

First, the risks—and there are risks—of making these structural changes must be weighed against the risks of not making the changes. As noted earlier, the most important of the risks associated with not making the changes is that it would frustrate the necessary process of consolidation, cost reduction, and diversification in the banking and financial system and further undermine the competitiveness of U.S. banking institutions at home and abroad. Put differently, absent these progressive structural changes, the risks of further stress and instability in banking and finance will increase.

Second, whatever else may be said of these changes,

they will, over time, work in the direction of permitting institutions to better diversify their risks and their sources of income. This is important because when we look for common denominators among institutions that have failed, one (other than poor judgment and management) that stands out time and again is concentration of activities and credit exposures. In this regard, it should be stressed that, over time, the benefits of diver-

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sification of risk and income flows that would follow from these structural changes would not accrue solely to banking institutions. To the contrary, I would think that important benefits would also arise for securities firms by virtue of their ability to own banks. I assume that this is one of the reasons that so many securities firms own nonbank banks in the United States and own banks in foreign countries.

Third, under the system of progressive supervision I have in mind, the benefits of the repeal of these outdated laws would accrue only to the strongest of institutions, taking into account not simply capital positions but also the full range of supervisory criteria. In this connection it should be noted that over the course of the recent credit crunch, call report data point to a striking difference between the rate of commercial and industrial loan origination by strong banks and that of weak banks in all parts of the country. In other words, while commercial and industrial lending has, of course, slowed across the board, that pattern is more evident at weak banks than at strong banks. This finding in itself is suggestive of why it is so important to promote strength and diversification in banking institutions.

Fourth, as a part of the process, there are several areas in which overall supervisory standards and practices must be strengthened. The system of progressive supervision based on capital zones that is part of the Treasury proposal and is incorporated into several other legislative proposals is responsive to this need for strengthening the supervisory process. However, capital and other prudential standards are, in my judgment, only as good as the on-site examination and inspection process. That is why I believe it is so very important that major emphasis be placed on strengthening the

examination process. In saying that, I recognize that there are several proposals before the Congress calling for annual examinations of all banks or banking institutions.

It is important that Congress recognize that achieving this goal—while important—is going to be expensive—

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very expensive. I say that with the knowledge that many banks are not now subject to annual examinations *and* with the knowledge that even when examinations occur annually, important differences can arise in the scope of the examinations in such crucial areas as the composition and size of the sample of loans reviewed by the examiners. While it will be expensive, Congress should also recognize that these costs will be very small relative to the costs of not taking the necessary steps to reinforce the examination process.

At the Federal Reserve Bank of New York we have maintained the practice of "full scope" annual examinations for virtually all institutions under our supervisory jurisdiction and certainly have maintained that practice for *all* major institutions under our jurisdiction. At times, the annual exam is supplemented by limited-scope or targeted examinations within a twelve-month period.

There is another important consideration in this regard. Namely, the examinations can only be as good as the examiners. I am proud of my examination force, and I know that they are good—damn good—at their profession. I believe these examiners are among the best in the business—a view that I suspect is shared by their peers here and abroad. But let's be realistic. The Federal Reserve Bank of New York employs 206 bank examiners whose average tenure is eight years and whose average salary is about $50,000. But these 200 individuals—together with their in-house analytical and support staff—are directly responsible for inspections of 7 of the 15 largest bank holding companies in the country with aggregate assets of over $650 billion, federal examinations of 5 of the 10 largest banks in the United States, and federal examinations or inspections of about 175 other banks or bank holding companies, as well as standby or backup examination authority for about 250 foreign banking institutions operating in New York. Their work covers not only financial examinations but also a wide range of so-called compliance examinations in such areas as community

reinvestment activities of banks.

What I am suggesting, of course, is that the demands on the bank examination process, regionally and nationally—a process that I regard as the bedrock of the overall supervisory process—are enormous. As an extension of that, the Congress must recognize that to get it right will entail added resources of not inconsequential dimensions. This will be especially true in a

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setting in which interstate banking will bring with it the need to redouble our efforts in such areas as compliance examinations regarding the Community Reinvestment Act. I might also add that the suggestion that restructuring of the bank examinations agencies would produce large offsetting savings is wrong. The amount of cooperation between the agencies at the federal level is considerable, and the amount of duplication is limited.

Fifth, this is not the time to relax supervisory standards as they apply to consolidated groups housing banking entities or to their parent holding companies. Not only would such a move be wholly incompatible with practices throughout the industrial world—practices that were recently confirmed in an emphatic fashion by the Swiss courts—but it would also ignore the fact that these holding companies are the financial and managerial nerve centers of the groups of entities they control. The holding company is also the major—and usually

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the sole—point of entry to the capital markets for the consolidated entity and all its component parts.

In those circumstances and in the face of the difficult current and prospective problems, the relaxation of prudential standards at the level of the holding company strikes me as a major mistake. Accordingly, consistent with the position I have taken before this Committee on earlier occasions, I strongly favor supervisory policies

at the level of the holding company that—at the least— would include (1) minimal capital standards on a fully consolidated basis, (2) a program of on-site inspections of such companies along the lines of current practices, (3) consolidated reporting requirements, and (4) standby authority for inspection or examination of any unregulated affiliate of a holding company controlling depository institutions.

I have carefully considered the arguments for a lesser degree of ongoing supervision of holding companies. Some of these arguments have some merit, even if I personally do not find them persuasive. But even if the arguments were fully persuasive as presented, they leave one glaring problem: namely, the suggestion that supervision can or will be strengthened when problems become apparent. The reality, of course, is that experience strongly suggests that when the problems become apparent, it is already too late.

Sixth and finally, it is possible to stage or phase in certain of these structural changes in such a way as to provide the Congress and the public with the necessary comfort that the process is occurring in an orderly fashion and in a manner ensuring that necessary changes in supervisory policies and practices are in place. There are any number of devices that could be used for this purpose. Further, at the risk of sounding bureaucratic, consideration might be given to the *temporary* establishment of a body styled on the Depository Institutions Deregulation Committee of the early eighties to coordinate and oversee this transition, including the preparation of periodic reports to the Con-

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gress on the progress of and problems with the effort.

There is no course of action open to the Congress in the banking reform process that is risk free. There are risks with no legislation; there are risks with narrow legislation; and there are risks with broad legislation. However, I am convinced that with appropriate safeguards and careful implementation, the risks associated with prudent broad legislation are lower and more manageable than the risks associated with the alternatives. Moreover, only broad legislation gets to the fundamentals that are at the root of so many of the current problems in the banking and financial system.

Deposit insurance, "too big to fail," and systemic risk

While caution is needed in all aspects of this effort, nowhere is the need for caution greater than in efforts to cope with the highly sensitive and interrelated problems of deposit insurance reform, "too big to fail," and systemic risk.

The economic and political sensitivities surrounding the so-called too big to fail issue are understandably great. In part that is true because of the obvious equity issues that arise in this connection. But the problems go well beyond the equity issues. For example, to the extent that practices produce a situation in which the financial landscape is littered with inefficient institutions—small or large—and to the extent that strong institutions must pay for the mistakes or abuses of weak or reckless institutions, the economic costs of such practices can be considerable.

Having said that, I should also say that the semantics of "too big to fail" are often misleading. On the one hand, shareholders, managers, and, increasingly, bondholders are not protected from "failure." On the other hand, we have seen any number of cases here and abroad in which decisions by governmental authorities—including state governments—have been made to protect broad classes of investors or depositors when

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The reality is that there are circumstances in which public authorities can and should reach the conclusion that the threat of losses on deposits—or perhaps even other categories of loss—carries with it risks to the well-being of the financial system as a whole that can easily justify taking extraordinary measures to protect against such losses.

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the banking institution that was at risk of failure was not at all large and in fact was quite small. What that says, of course, is that while the phrase "too big to fail" is catchy, the reality it seeks to describe is much more complex than the words suggest. The reality is that there are circumstances in which public authorities can and should reach the conclusion that the threat of losses on deposits—or perhaps even other categories of loss—carries with it risks to the well-being of the financial system as a whole that can easily justify taking extraordinary measures to protect against such losses. In other words, the authorities cannot afford to ignore the systemic risk phenomenon.

Systemic risk is one of those things that is hard to define but easy to recognize. Indeed, speaking as someone who has been at least indirectly involved with

efforts to contain virtually every major financial disruption in this country for more than a decade, I can assure you that the threat of systemic risk can be very real. I can also say that while we have had a few close calls, we have not had a situation in which serious problems in one institution, a class of institutions, or a segment of

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the financial markets have spread to other institutions and markets in such a way as to inflict serious and very costly damage on financial markets generally or on the economy. Those latter conditions are, of course, what moves systemic risk from threat to reality.

With that in mind, a natural question is: What is it about financial institutions and financial markets that creates the systemic risk problem in the first instance? The short answer can be given in two words: confidence and linkages. The confidence part of that answer is well understood. But it should be stressed that the confidence factor relates not only to public confidence in financial institutions but also to public confidence in the authorities' understanding of these institutions and markets and to public confidence that the authorities will act in a responsible fashion when confronted with problems.

The linkage aspect of the systemic risk problem,... while related to the confidence problem, grows out of the enormously complex network of counterparty credit, liquidity, settlement, and operational risks and contingent risks on a national and international scale that characterizes contemporary financial markets and institutions.

The linkage aspect of the systemic risk problem, unfortunately, is not always well understood. The linkage problem, while related to the confidence problem, grows out of the enormously complex network of counterparty credit, liquidity, settlement, and operational risks and contingent risks on a national and international scale that characterizes contemporary financial markets and institutions. The scale and complexity of these contractual obligations and counterparty risks are very difficult to convey. Let me try by way of example.

On a typical business day, the Federal Reserve Bank of New York processes or settles about $2 trillion in electronic transfers or payments. While I can only guess, it would not surprise me if the total daily payment flows through the New York money markets were at least double that amount. To put that in perspective, a heavy day on the New York Stock Exchange entails transactions with a value of only $8 billion or $9 billion. At the other extreme, the GNP for the United States for the year 1990 was $5.5 trillion. Virtually all banking institutions—small and large, local, regional, and national— have direct or indirect credit or counterparty exposures that grow out of these transactions flows.

The reason that these linkages are so important to the systemic risk issue is that in the face of a problem or a perceived problem at a particular institution or group of institutions, other institutions will, quite naturally, take steps to protect themselves from outright loss and from the threat that money, securities, or other financial assets will not be delivered to them or that existing contracts will not be honored. This, in turn, gives rise to the threat of financial "gridlock," a threat that can easily take on the classic characteristics of a self-fulfilling prophecy. If, in those circumstances, confidence in the workings of the system begins to erode,

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the systemic problem is at hand. In this context, it is very important to recognize that when all is said and done, the payment flows that permit the system to work can be made only through transactions accounts at banks.

This, of course, is why the payments system is so very important to the stability and integrity of the financial and economic system. It is also why the Federal Reserve, like most central banks, plays a direct role in the operation and the oversight of the payments system. It is also the reason that payments, clearance, and settlement systems can so easily be the mechanism through which a localized problem in the financial system can take on systemic elements. Finally, it is the reason that in recent years the Federal Reserve has put so very much effort into improvements in the safety, integrity, and reliability of payment, clearance, and settlement systems and, in the process, has assumed a position of leadership in parallel efforts throughout the world.

Because these issues of confidence and linkages are

so central to the systemic risk problem and because they are so subtle, so complex, and at times so threatening, some may question the wisdom of specific decisions made from time to time by the authorities in the face of particular problems in the financial system. That is understandable, but I am quite sure that there would be a great deal more questioning if a miscalculation resulted in a seemingly isolated event triggering a widespread and very costly systemic problem.

Looked at in that light, the problem is not that any institution is too big to fail. The problem is that there are institutions and there are circumstances—*and not just circumstances involving banks or big banks*—when the sudden and uncontrolled demise of one or a group of institutions, large or small, could unleash a series of events that take on systemic implications. In some cases, that reality requires that the authorities step in and play a major role in doing all that can reasonably be done to ensure that the demise of such an institution takes place in an orderly fashion. This was the case with Drexel. In other cases, it might require, for example, that all depositors in a bank be kept whole even in the face of insolvency and the $100,000 formal limit on deposit insurance.

Systemic risk—especially in its very complex contemporary form—is a reality. It cannot be legislated away; it cannot be regulated away.

What I am suggesting, of course, is that systemic risk—especially in its very complex contemporary form—is a reality. It cannot be legislated away; it cannot be regulated away; and as suggested by experience all over the world, neither it nor the behavior of the authorities in the face of stress in the system arises out of the mere presence of a formal system of deposit insurance, no matter how poorly or how well that system is designed or administered.

To put it differently, any satisfactory solution to the "too big to fail" problem and the related issue of deposit insurance reform must start with efforts that will reduce the risk of failures in the system at large and efforts that will provide the authorities with the tools and the ability to better contain and manage problems when they arise. This, again, is why broad legislation is so necessary; the structural changes get at the first of these needs, while the supervisory and regulatory changes—including early intervention—get at the second.

I might add in this regard that early intervention may also help overcome one of the major practical obstacles to greater reliance on "open bank" solutions to problem institutions. That is, under current practices, it is difficult

to organize competitive bidding packages for seriously weakened but still solvent and open banks. With clear legislation permitting early intervention in such circumstances, the benefits of competitive bidding can be realized even though the bank is open and technically solvent.

This can be very important because experience clearly suggests that the losses in banks that no longer have "going concern" value tend to increase dramatically, thus raising the cost to the deposit insurance fund. More importantly, open bank solutions clearly can help to contain and reduce the systemic risk problem, and anything that works in that direction also works in the direction of reducing the inequity and other problems associated with "too big to fail."

In all these circumstances, there are clear limits on how much can safely and constructively be done in the area of deposit insurance reform at the present time. As the banking system regains its strength, that will change. However, there is one aspect of the deposit insurance issue that warrants further comment, and that relates to brokered deposits. There is no question that in the savings and loan mess the abuse of brokered deposits was a major contributor to the overall problem. Partly for this reason and partly because it is now so easy and so inexpensive to break large chunks of money into $100,000 pieces and deploy such monies into fully insured deposit accounts in multiple banking institutions, the brokered deposit phenomenon seems to collide head on with one of the basic purposes of

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deposit insurance. For that reason, and because practical alternatives are hard to come by, the Treasury proposal would essentially eliminate insurance coverage on brokered deposits over a two-year period.

While that approach has some appeal, it has the obvious disadvantage that it would eliminate those aspects of the brokered deposit market that serve a constructive purpose. I can see only one way to protect against the abuses of brokered deposits while still maintaining a viable marketplace for brokered deposits. That approach would center on attacking the problem not at the source but at the use. It might be possible, for example, to further strengthen the provisions of the Finan-

cial Institutions Reform, Recovery, and Enforcement Act as they pertain to brokered deposits by some combination of (a) adding disclosure rules, (b) providing explicit cease and desist authority regarding the use of brokered deposits by *any* depository institution, and (c) establishing of licensing or registration requirements for all money brokers.

I can see only one way to protect against the abuses of brokered deposits while still maintaining a viable marketplace for brokered deposits. That approach would center on attacking the problem not at the source but at the use.

If something along these broad lines cannot be made to work, I must confess I would then side with the Treasury, even though I recognize that this approach has the obvious disadvantage of throwing away the good with the bad.

To summarize, given the current condition of the banking system and the difficult transition that lies ahead even under the best of circumstances, there are no easy answers to the closely interrelated issues of deposit insurance reform, "too big to fail," and systemic risk. To the extent that the Congress can enact broad and progressive legislation along the lines described earlier, such legislation would attack these problems from two directions: First, the combination of progressive supervision, prompt resolution, Fed-Treasury discretion in the face of systemic problems, limited changes in deposit insurance, and a strengthened system of supervision and examination would tend to contain and minimize these problems over the next several years of transition. Second, structural changes in such

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Structural changes in such areas as McFadden, Douglas, and Glass-Steagall—with the safeguards suggested—would work in the direction of facilitating an orderly process of consolidation while providing greater opportunities for profitability and diversification, thereby getting at the heart of the structural and competitive problems in banking and finance.

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areas as McFadden, Douglas, and Glass-Steagall—with the safeguards suggested—would work in the direction of facilitating an orderly process of consolidation while providing greater opportunities for profitability and diversification, thereby getting at the heart of the structural and competitive problems in banking and

finance.

As this transition occurs, the Congress and others should give further consideration to what additional steps might be taken to strike a better balance between the workings of the marketplace and reliance on the safety net. In that setting, consideration could be given to other possible reforms in deposit insurance, perhaps along the lines suggested by Senator Dixon and others. Who knows for sure? Maybe we will get lucky, and the progressive legislation of 1991 might yield an outcome by 1994 or 1995 that does not require further major surgery.

Supervisory policy and the role of the Fed
On a number of earlier occasions I have stated to this Committee my belief that the Federal Reserve, as the nation's central bank, must maintain an important role in the bank supervisory process. In saying that, I have acknowledged that such a statement, coming from me, cannot help but be construed by some as a position that is motivated by institutional self-interest. I recognize that danger, but because I believe the principle is so important, allow me to conclude with a further elaboration on this point.

As with any chief executive officer, one of my most important duties is to try to motivate the employees who work for me and to try to make sure they understand why their individual jobs are important and how their individual duties fit into the bigger picture. In doing this, I often refer to what I like to call the "trilogy" of responsibilities of the central bank. The concept of the trilogy is borrowed from the literary world where its definition centers on three works that are closely related and develop a single theme. In the context of the Federal Reserve, the three components of the trilogy are: monetary policy, which, of course, stands at the center of the trilogy; the broad oversight of financial markets and institutions, with special emphasis on banking institutions; and the oversight of and direct participation in the workings of the payments system. If those are the elements of the trilogy, the single theme that unites them is stability: price stability, financial stability, and overall economic stability.

The components that make up that trilogy of functions are not separate and distinct; each depends on the others in precisely the same manner that the components of the literary trilogy depend upon one another. If any one is left aside, the essence and common theme of the trilogy are lost.

While the analogy of the trilogy may be new, the recognition of the interrelationship of these specific functions is not. Indeed, that recognition was at the very center of the thinking that went into the creation of the Federal Reserve in 1913. In fact, the preamble to the

Federal Reserve Act specifically mentions the role of the Fed in the supervisory process. It reads: "to provide for the establishment of Federal reserve banks, to furnish an elastic currency, to afford means of rediscounting commercial paper, to establish a more effective supervision of banking in the United States, and for other purposes."

Against that background, I must confess that I find it a little difficult to comprehend the view that essentially says, "let the Fed tend to its monetary policy knitting and leave bank supervision to others." I find that view especially difficult to comprehend in the context of supervisory responsibilities as they apply to major banking organizations, where the systemic risk problem can be so very real.

As I see it, the view that monetary policy is separate and distinct from supervisory policy and that either or both can be separated from the workings of the payments system and from the systemic risk problem can be based only on a dangerously narrow view of what monetary policy is all about.

As I see it, the view that monetary policy is separate and distinct from supervisory policy and that either or both can be separated from the workings of the payments system and from the systemic risk problem can be based only on a dangerously narrow view of what monetary policy is all about. Indeed, if there was nothing more to monetary policy than a mechanical decision whether the central bank buys or sells on a given day, one could argue that monetary policy and bank supervision are separate and distinct functions. But in the United States and throughout most of the industrial world, this sharp distinction is not accepted. Indeed, the drafters of the proposed statute for the European System of Central Banks and the European Central Bank have included among the five basic tasks of the European Central Bank the following: "to participate as necessary in the formulation, co-ordination and execution of policies relating to prudential supervision and the stability of the banking system."

In practice, monetary policy is not, and will never be, a simple mechanical decision to buy or sell. It entails judgment, and one very important component of that judgment relates to conditions in financial markets and financial institutions, including a detailed working knowledge of such markets and institutions. For example, monetary policy was appropriately influenced by such events as the recent "credit crunch" and the 1987 stock market crash. In other cases, such as the Drexel episode or the "mini" market crash of 1989, monetary

policy was not so influenced. In all such cases, however, the decision whether such events should influence monetary policy—even if only for a matter of days— must be faced and made one way or the other. Obviously, such decisions must be made in an informed manner. A very crucial ingredient in that decision mak-

In practice, monetary policy is not, and will never be, a simple mechanical decision to buy or sell. It entails judgment, and one very important component of that judgment relates to conditions in financial markets and financial institutions, including a detailed working knowledge of such markets and institutions.

ing comes from the direct, hands-on knowledge of the Federal Reserve that grows out of its supervisory responsibilities and its resulting close interaction with banking institutions—institutions that remain the "cushion" or the "shock absorber" of the financial system as a whole. Moreover, I can assure this Committee that the necessary insights to make those decisions cannot be gained simply by reading some other agency's examination or inspection reports.

This is not to say that there may not be, from time to time, conflicts between monetary policy and super-

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visory policy. To the contrary, such conflicts do arise. The point is that in resolving those conflicts, the central bank must be part of the solution and not part of the problem.

The direct linkages between banking supervision and the conduct of monetary policy are important, but they do not tell the whole story why it is crucial that the Fed continue to play a major role in the supervisory process. What is even more important is that the stability of the financial system is a prerequisite not only to the conduct of monetary policy but also to the very goals of price stability and economic stability. They are a package deal; you cannot have one without the others. That is why every central bank that I know of is the "lender of

last resort"; that is why the integrity and safety of the payments mechanism is so important; that is why the central bank must concern itself with the safety and soundness of those institutions that constitute the nerve center of the financial system at the local, regional, and national levels.

In these circumstances, I would hope that any restructuring of the responsibilities of the federal bank

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regulatory agencies would preserve a lead role for the Federal Reserve. Having said that, I will quickly add that I see no reason to undertake that regulatory restructuring task now. For one thing, the status quo, while not perfect, does work reasonably well. Beyond that, logic suggests the wisdom of getting the structural reforms of the banking and financial system firmly in place and then forging the regulatory apparatus to meet the needs of the changed system as it takes hold in practice. Finally and perhaps most importantly, it seems to me quite risky to try and put in place massive regulatory restructuring as we work our way through the very

difficult transition that lies ahead. That would only elevate the risk that something of consequence will fall between the cracks.

Summary
My opposition to legislation that would permit commercial firms to control banking institutions is well known to this Committee. I have tried in this statement, and in its attachment, to spell out in detail the reasons for that position. But as strong as my opposition to banking-

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Few items on the national agenda strike me as having greater long-run implications for the health and competitiveness of our banking and financial system—and therefore our economy—than does the enactment of such broad-based progressive legislation this year.

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commerce combinations is, my support for what I have described as progressive but cautious legislation is even stronger. Few items on the national agenda strike me as having greater long-run implications for the health and competitiveness of our banking and financial system—and therefore our economy—than does the enactment of such broad-based progressive legislation this year.

Inflation: Measurement and Policy Issues

by Richard G. Davis

Inflation poses problems for the functioning of any economy. This article seeks to examine several broad topics relating to inflation. In particular, it looks at (1) problems of measuring inflation, (2) the costs imposed by inflation, and (3) the problems of anti-inflation policy.[1]

Measurement of inflation

The main price series used to measure and analyze inflation are the consumer price index (CPI), the producer price index (PPI), and the "implicit" (or floating-weight) and fixed-weight GNP deflators. Some of the principal features of these measures are summarized in Table 1, and they are discussed in more detail in the following two articles. While all these measures have important analytical uses, the CPI can reasonably be regarded as "the" measure of inflation since it is the only one specifically designed to measure the purchasing power of money for the average final consumer of goods and services. Thus the following brief discussion of measurement issues focuses on the CPI.

The CPI is probably one of the best pieces of economic data we have. It is drawn from a very large monthly sample of actual prices that takes account of discounts, rebates, and other factors affecting actual transactions prices. Unlike most other series, it is not subject to revision, except for minor periodic revisions of seasonal adjustment factors. Nevertheless, the CPI

does have some significant problems and limitations.

First, it is a *base*-weighted measure, that is, the weights attached to its individual components are derived from expenditure weights in a base period that is updated only about every ten years. This means that the index reflects changes in prices only. Consumers can and do adjust their expenditure patterns to reduce consumption of items whose prices are rising relative to the prices of other items. Consequently, the CPI as a measure of the resulting decline in the "satisfaction" that can be purchased with a given number of dollars is overstated.

A floating- or current-weighted index such as the implicit GNP deflator has an opposite bias. It implicitly assumes that a shift in spending patterns induced by rises in prices imposes *no* loss of "satisfaction." This is obviously an overstatement. To that extent, floating-weight deflators *understate* the decline in "satisfaction" that can be purchased with a given amount of money as a result of rising prices. There is no objective solution to this problem of (opposite) biases in base- and current-weighted price measures since what is fundamentally at issue is the change in the "satisfaction" a given number of dollars will buy when prices change. In any case, it should be noted that the bias of a base-weighted measure such as the CPI tends to become larger over time, especially given imperfect adjustment for the introduction of new products not included in the original base period weighing.

A second measurement issue concerns the need to allow for quality changes in the items being priced. The Bureau of Labor Statistics (BLS) in principle adjusts the CPI for quality improvements, but the adequacy of such

[1] This article and the first two "In Brief" Economic Capsules that follow were originally prepared as background material to stimulate discussion on inflation issues at a meeting of the Federal Reserve Bank of New York's Board of Directors. The views expressed are those of the author and do not necessarily reflect the views of the New York Federal Reserve Bank.

adjustments varies. Fairly elaborate procedures are used to adjust for quality changes in such items as new cars, but the most serious problems probably are located in the services sector, as indicated in the article on service prices. It appears likely, for example, that inability to account for quality changes is a significant factor in the rapid rise reported in the price of health services. Overall, specialists who have studied the quality problem have tended to argue that inadequate quality adjustments do impart some upward bias to the CPI, but probably one that amounts to no more than about 1 percent.

Probably the most serious quality issue of recent years has been created by the rapid improvement and growing importance of computers. But this problem is much more serious in regard to the GNP deflator (and hence in measuring the growth of "real" GNP and productivity) than it is for the CPI.

One of the most important measurement problems relating to the CPI is its treatment of the "implicit rent" costs of owner-occupied homes, an item with a large 18 percent weight in the total index. In 1983, the BLS repaired a major defect in the index when it switched from an asset price approach to housing costs (which tended to be dominated by movements in mortgage rates and hence in long-term interest rates) to a current services approach. The problem is that the conceptually correct "implicit rental cost" of owner-occupied houses is hard to measure because the rental market for single family homes is thin. Recently, this component has been suspected of contributing to upward bias in the CPI because the recorded inflation rate of the component remained in a 4 to 5 percent range despite the well-known weakness in a number of sections of the housing market. Unfortunately, there seems to be no

good way to quantify the extent of the upward bias, if any.

Finally, a word should be said about inflation in "asset" prices—that is, prices of the stock of existing residential and nonresidential real estate, land, mineral deposits, equities, fine art, and the like. None of the major price series includes prices of such assets since the series are all intended to measure consumption items (CPI) or currently produced items (the PPI and GNP deflators). In common usage, "inflation" by and large refers to prices of currently consumed and produced items rather than to asset prices. But there are no hard and fast rules on this, and the same processes that generate inflation in current goods and services may also generate inflation in asset prices. Broad movements in most asset prices show some tendency to parallel broad movements in CPI inflation, but these inflation rates may differ quite substantially for long periods.

Overall, it is clear that the CPI has some significant technical problems. Nevertheless, it is basically a well-designed and well-maintained measure of inflation, and the technical problems it poses are not important relative to the much larger issues of how to deal with inflation. The existence of these problems does support the wisdom of defining price stability in somewhat flexible language rather than equating it with a pseudo-precise "zero" inflation rate as measured by some particular series.

Real effects and costs of inflation

It has proved far easier to describe the costs of inflation qualitatively than to measure them quantitatively. The effects of inflation seem to be of five general kinds: (1) increased costs of repricing more frequently and more

Table 1

Inflation Measures

	Consumer Price Index	Producer Price Index	Implicit GNP Deflator	Fixed-Weight GNP Deflator
Weighting scheme	Fixed-weight based on 1982-84 consumer spending	Fixed-weight based on 1982 shipments	Current-weight based on component share of GNP	Fixed-weight based on 1982 component share of GNP
Services included?	Yes	No	Yes	Yes
Imports included?	Yes	No	No	No
Asset prices included?	No	No	No	No
Effort made to adjust for quality changes?	Yes	Yes	Yes	Yes

frequent "trips to the bank," (2) effects on the allocation of output, (3) effects on the efficiency of the pricing system as a signaling device, (4) effects on income distribution, and (5) effects on social and political stability. In examining these effects, economists make a useful analytical distinction between anticipated and unanticipated inflation. A further distinction between the expected amount of inflation and the level of *uncertainty* surrounding inflation expectations also seems useful.

In principle, a fully anticipated rate of inflation would have only a few, quantitatively minor real effects. To be fully anticipated, an expected (and realized) rate of inflation would have to be built into all long-term contracts, all institutional arrangements for making payments, and interest rates. Even if all these adjustments were made, a fully anticipated inflation would still have important real effects unless the tax system were fully indexed, which of course it is not. But if *all* these various conditions were met, the real effects of inflation would in theory be very minor. Repricing would have to be done more often in the presence of inflation ("menu costs"), people would hold smaller amounts of zero interest cash and so would have to go to the bank more often ("shoe leather costs"), and the government would benefit through a reduction in its real interest burden via the effects of inflation on its zero interest liabilities. But this is about all.

Obviously, fully anticipated inflation is nothing more than a theoretical construct. It is doubtful whether all the institutions of any economy have ever been fully adjusted to inflation, and in very high-inflation economies with elaborate indexation schemes, these schemes are invariably less than perfect. The distinction does emphasize, however, that there are important differences between the effects of unexpected inflation and the effects of an inflation that is at least partly anticipated and incorporated into institutional arrangements and economic decisions. As discussed further below, there is at least indirect evidence that the fairly steady and low inflation of recent years is largely, though certainly not fully, built into expectations and arrangements.

Unanticipated inflation has all the effects of anticipated inflation, the first item in the above list, plus most or all of the other effects cited. Effects on the allocation of output and on the general efficiency of the economic system undoubtedly vary with the precise circumstances. Interaction of inflation with the tax system, for example, is likely to discourage output of long-lived business capital assets but may favor investment in housing, thus hurting longer run potential growth. More resources will be devoted to speculative activity and to production of commodities whose prices are likely to respond to inflationary pressures most rapidly. The overall efficiency of the pricing mechanism may be hurt as unanticipated inflation raises the noise-to-signal ratio given out by prices.

Unanticipated inflation obviously has widespread and complex income distribution effects. Clearly creditors and all recipients of payments fixed by long-term contracts in nominal terms (including multiyear wage contracts) are hurt. In general, wages and profits will be hurt in industries that, for whatever reason, tend to have relatively slow responses to changes in market conditions. The government is "helped" by increases in the real tax rate on such items as capital gains and interest income, while the real value of its outstanding debt is reduced. Financial intermediaries are hurt by inflation that is unanticipated (and thus not built into nominal interest rates) as net interest margins fail to offset declines in real net worth. Obviously the list of such effects could be elaborated.

An increase in the degree of *uncertainty* surrounding any mean expected rate of inflation probably has additional effects. In particular, the persistently high nominal long-term rates relative to the reported long-term inflation expectations of financial market participants in the 1980s (that is, an implied high level of "real" long-term rates) seem plausibly explained in part by an increased uncertainty premium demanded by lenders in the face of the widely varying inflation experience of the past two decades. Any increased uncertainty surrounding the mean expectation of a variable so pervasively important as the expected inflation rate is likely to pose problems for a wide range of economic decisions and will discourage long-term contracts generally. Although the limited number of statistical studies on the subject have produced somewhat mixed results, it seems quite plausible to argue that the degree of inflation uncertainty is positively related to the *level* of inflation. If this is so, inflation uncertainty represents a significant further cost that must be attributed to the effects of an increase in the average rate of inflation.

At a more subtle level, all unanticipated inflation puts a strain on the social compact since it undercuts the perceived fairness and predictability of economic outcomes. In effect, inflation rewards and punishes individuals in a random way (or at least "random" from the individual's point of view) and distorts the real consequences of all kinds of contracts and agreements, explicit and implicit. At some point, inflation is likely to begin to weaken social and political stability. The classic example is of course the German hyperinflation of 1922-23. But in general, high rates of inflation tend to be associated with social and political strains, both as cause and effect. Obviously the level of inflation and inflation uncertainty at which such interactions begin to become significant will vary with circumstances.

The short- to intermediate-term costs of reducing inflation

The record clearly suggests that significant reductions of ongoing inflation rates have almost invariably entailed short- to intermediate-term costs. To see why this should be so requires at least a brief consideration of the cause of inflations. The proximate cost of continuing inflation is a level of aggregate demand (read nominal GNP) exceeding the economy's sustainable capacity to generate real output as determined in part by demographic, technological, and capital stock factors. The monetarist view of inflation goes on to say that continuing excess growth in aggregate demand can only occur in the presence of a correspondingly excessive monetary growth. This proposition can probably be accepted in a suitably long-run context and with some additional qualifications, but it is, in any case, a separate issue for present purposes.

The idea that continuing inflations are caused by "excess" aggregate demand is almost, but not quite, a truism. Supply shocks can also produce one-shot jolts to the price level that are experienced as a (temporary) rise in the inflation rate. Obvious examples are increases in taxes on commodities and wages (such as social security taxes), increases in commodity prices caused by cartels or other supply factors, and developments such as capital flight that depress the exchange rate and thus raise import prices. It has also been argued that significant changes in industry and labor market structure (such as may have been produced by the National Recovery Act and the Wagner Act of the 1930s) can have at least a one-shot upward effect on the price level. But these various kinds of supply side shocks will not have permanent effects on the inflation rate unless they get built into price expectations in a process that must ultimately be ratified by policies affecting aggregate demand.

In classic cases of very rapid demand inflation, one often finds a situation in which a government, in pursuit of income redistribution or other objectives, runs very large deficits associated with subsidies to consumers and/or to state-owned enterprises, deficits that are financed by borrowing from the central bank. This borrowing, in turn, results in a corresponding increase in bank reserves and generates a correspondingly rapid growth in the money supply. In such cases, the interrelationship between fiscal policy (the politically determined deficit) and monetary policy (the associated expansion of reserves and money) constitutes a single process whose component effects on inflation are impossible to disentangle. At a more fundamental level, of course, the real cause of such inflations is the failure of the political system to achieve whatever distributional or other objectives it may have through taxation rather

than inflation. South America has offered many examples of this process and Eastern Europe may well offer more.

Policies to reduce or eliminate an ongoing inflation have basically been of two kinds: wage and price controls and restraint on the growth of aggregate demand. There is ample evidence that the first of these approaches, at least when used by itself, produces only economic distortions with accompanying social and political pressures and, worse yet, inevitable failure to achieve its objective. One need only think back on the various phases of the Nixon programs of the 1970s or the numerous control plans introduced in Latin America in recent years. The best that can be said for the controls approach is that under the right conditions, controls *may* reduce the time and pain that would otherwise have to be endured as a side effect of the aggregate demand policies needed, with or without controls, to end inflation. Still, it is at least an open question whether controls are worth the problems they create even when used in conjunction with appropriately restrictive demand policies. In some cases, the controls appear to have been used mainly to provide political cover for demand policies that were in fact insufficiently restrictive to do the job. In any event, when controls do prove to be a beneficial adjunct to aggregate demand policies, their effect probably comes from reducing inflationary expectations more quickly than would otherwise be the case. This, in turn, would lower the short-term real output costs of reducing inflation through demand policies alone.

While restraint on aggregate demand can successfully be used (a) to halt an ongoing *acceleration* in the rate of inflation, (b) to lower an ongoing *level* in the rate of inflation, or (c) to eliminate inflation altogether (abstracting from supply shocks), history suggests that such successes almost inevitably entail short- to medium-term costs in real output and employment. These costs may be felt as a *permanent* slowing of the real growth rate (if the pre-existing growth rate was above the sustainable long-term rate), as a *temporary* slowing of the real growth rate, or as a temporary outright decline in real output. In the United States at least, major reductions in the ongoing rate of inflation have generally been associated with temporary outright declines—that is, with recessions.

An obvious question is why restraint on aggregate demand seems necessarily to involve short- to intermediate-term restraint on real output. Although the issue is much puzzled over by some theorists, the real-world explanation seems obvious enough. If prices, wages, and rents were to adjust immediately to slowdowns in the growth of aggregate demand, real output would not be affected and control of inflation would be

essentially painless. But the fact is that most prices, wages, and rents are sticky, and many are very sticky. As a result, if aggregate demand policy slows the ongoing rate of growth of nominal GNP by x percentage points, most of the short-run impact will be on the real component of GNP. Only gradually will prices slow in line with slower aggregate demand growth. Real output can ultimately resume its original growth rate, but this time with slower growth in both nominal demand and prices.

The phenomenon of sticky prices is a source of perplexity to academic theorists who start from the classical premises of pervasively competitive markets peopled by maximizing buyers and sellers with "rational" expectations and characterized by prices that adjust continuously to market clearing levels. Thus to such theorists, it is not obvious why "rational" buyers and sellers should persist in agreeing to trade at non-market clearing prices and wages for long periods of time—a situation that clearly exists in the state of rising unemployment and excess capacity associated with

restrictions on aggregate demand in the short to intermediate run. Prices in organized commodity exchanges and financial markets fluctuate hourly in response to seasonal, cyclical, and erratic changes in demand. By contrast, the demand for the morning paper shows clear intraweekly, seasonal, and other variations, yet its price may remain unchanged for years. Many more prices, wages, and rents in the real economy look like the price of the morning paper than look like prices in the Chicago commodity pits. In any case, the phenomenon of sticky prices is pervasive and appears to be fundamental to the nature of the inflation problem.

As noted, the historical record is clear in showing that major slowdowns in the rate of inflation have been associated with increased slack in real activity as indexed by the unemployment rate. Chart 1 shows the postwar experience in the United States and Charts 2 to 5 suggest a similar relationship over the past fifteen years in other major industrial countries. Table 2 shows the cumulative excess of unemployment over the estimated "normal" or "natural" rate of unemployment that

Chart 1

Inflation and Unemployment Rates in the United States, 1958-90

Percent

Unemployment rate
Four-quarter moving average

Consumer price index excluding food and energy
Change from four quarters earlier

1958 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91

Note: Shaded periods are periods of slowing inflation.
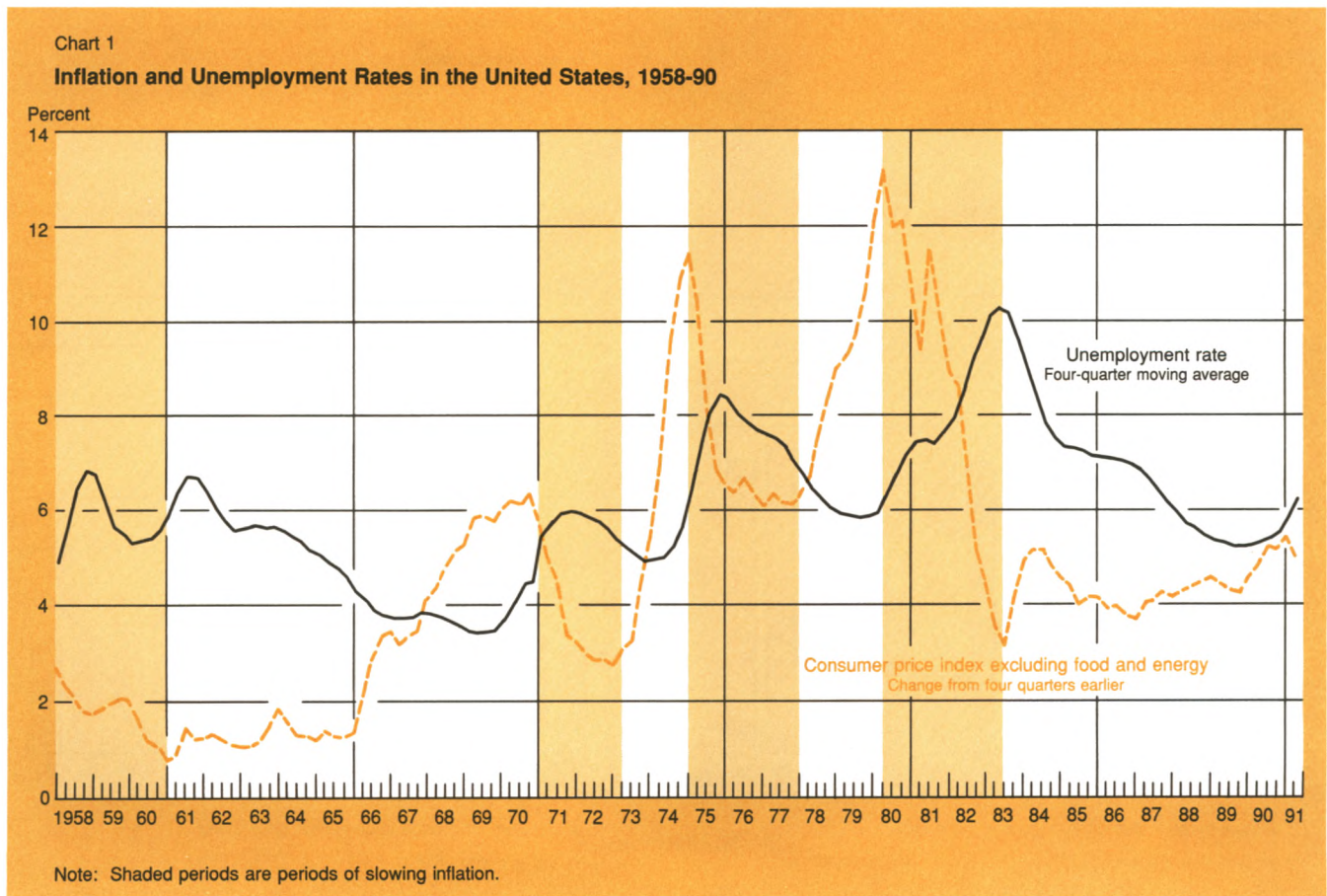
Chart 2

Inflation and Unemployment Rates in the United Kingdom, 1977-90

Percent

Inflation *

Unemployment rate †

1977 78 79 80 81 82 83 84 85 86 87 88 89 90
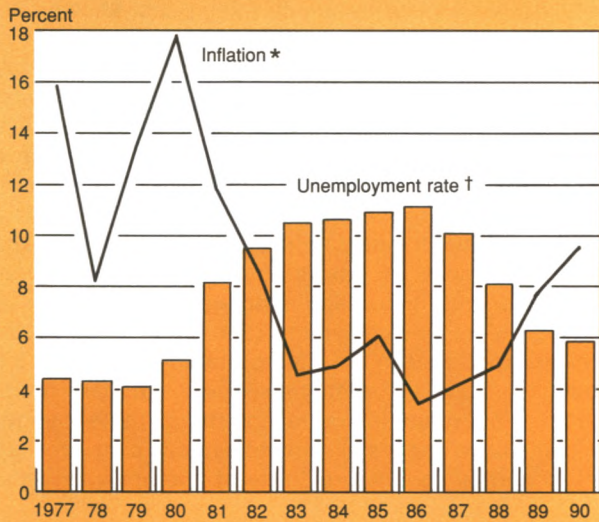
* Annual percent change in consumer price index.

† Annual average level.

Chart 4

Inflation and Unemployment Rates in Germany, 1977-90

Percent

Unemployment rate †

Inflation *

1977 78 79 80 81 82 83 84 85 86 87 88 89 90

* Annual percent change in consumer price index.

† Annual average level.

Chart 3

Inflation and Unemployment Rates in France, 1977-90

Percent

Inflation *

Unemployment rate †

1977 78 79 80 81 82 83 84 85 86 87 88 89 90

* Annual percent change in consumer price index.

† Annual average level.

Chart 5

Inflation and Unemployment Rates in Japan, 1977-90
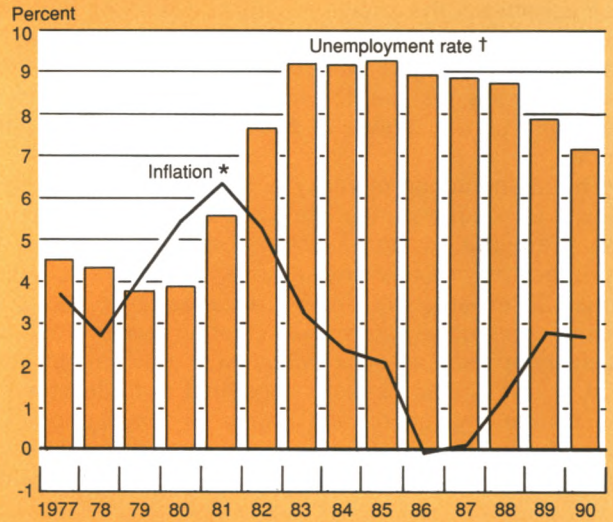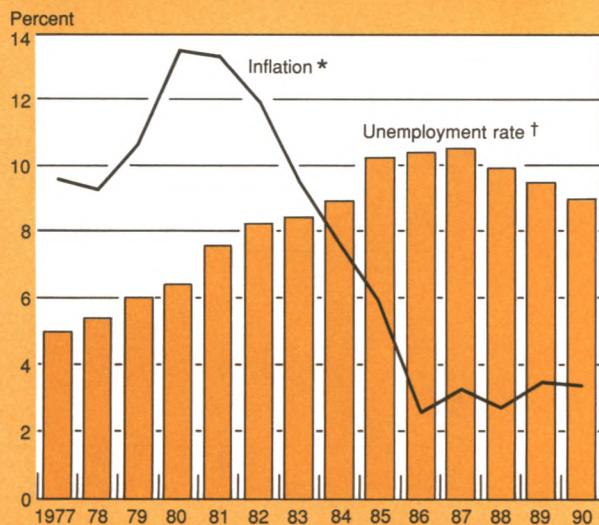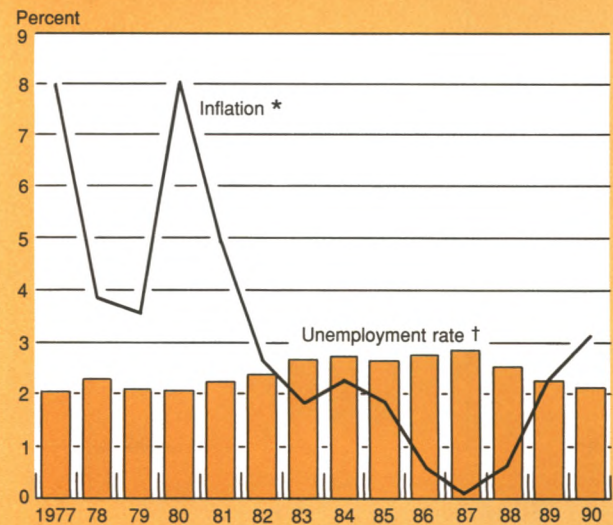
Percent

Inflation *

Unemployment rate †

1977 78 79 80 81 82 83 84 85 86 87 88 89 90

* Annual percent change in consumer price index.

† Annual average level.

has been associated with major slowdowns in inflation in the United States and in foreign economies. While no two of these episodes are exactly alike, experience in both the United States and abroad suggests that on average, a 1 percentage point reduction in the rate of inflation has been associated with about a 2 percentage point excess of unemployment over the "natural" rate—an excess that could represent either a 1 point excess for two years or a 2 point excess for a single year.

It is important to make clear that experience cited in the charts and table is *not* evidence of a long-run or permanent "trade-off" between the level of the inflation rate and the level of unemployment such as was widely believed to exist in the late 1950s and early 1960s. Subsequent experience decisively refuted the existence of any such relationship, at least in the United States, and more probing theoretical analysis has argued that there has never been any reason to expect, *a priori*, that such a trade-off would exist. Actually, the post-1960 data for the industrial countries as a group has suggested a rise in the average levels of *both* inflation and unemployment. The conclusion supported by the evidence presented in the charts and tables is simply the point already made: Slowing the rate of inflation is likely to be associated with a temporary increase in economic slack.

To be a little more specific, the old, so-called Phillips curve posited an inverse relationship between the sustained level of inflation and the sustained rate of unemployment. Data for the postwar United States show no correlation between these two measures. Few now believe that we can "buy" a permanent reduction in the unemployment rate by a step-up in the ongoing inflation rate or that, conversely, a permanent slowing in the inflation rate need be paid for by a permanently higher level of unemployment. What the data do show is that the *rate of change* in the inflation rate is inversely related to the level of unemployment. The most widely accepted view, discussed in a later section, is that below some "natural" rate of unemployment (also called the "nonaccelerating inflation rate of unemployment" or NAIRU), inflation tends to accelerate. At levels of slack above this natural rate, inflation tends to slow. Thus an ongoing inflation rate can be slowed by a temporary rise in unemployment above its natural rate. Once inflation has been moderated by the resulting slack in resource utilization, unemployment can revert to its natural rate and, as long as it stays close to that level, the improvement in inflation can be permanently sustained.

The general conclusions about the relation of inflation to real growth over sustained periods—that, in the long run, higher inflation can't buy lower unemployment and more rapid growth and that, indeed, for reasons suggested in the previous section, inflation may sap an economy's potential for longer term growth—are consistent with data covering a cross-section of countries over the decade of the 1980s (Table 3). For a group of twenty-four countries with average annual inflation rates of less than 11 percent (mostly industrialized countries), there was essentially no significant correlation between average inflation and average real growth. For another group of nineteen countries with average annual infla-

Table 2

"Excess" Unemployment Associated with a 1 Percentage Point Slowing of Inflation

		(1) Reduction in Inflation Rate (Percentage Points)	(2) Cumulative Excess Unemployment (Percentage Points)	(3) Excess Unemployment per 1 Point Cut in Inflation (2)/(1)
U.S. experience†				
1. 1957-61		2.6	7.1	2.6
2. 1970-72		0.8	0.8	1.0
3. 1975-77		3.1	6.8	2.2
4. 1981-85		6.7	11.8	1.8
Foreign experience‡				
5. Germany	(1980-85)	2.6	12.8	4.9
6. France	(1982-87)	8.8	18.6	2.1
7. Japan	(1980-85)	2.4	2.0	0.8
8. United Kingdom	(1980-85)	13.7	29.4	2.1

† Based on staff estimates of natural rates of unemployment.
‡ Based on Office for Economic Cooperation and Development estimates of natural rates of unemployment.

tion of more than 17 percent, there was a significant *negative* correlation between inflation rates and growth rates—that is, inflation seems to have been bad for growth over the longer run. The combined group of forty-three countries also showed a statistically significant negative correlation between inflation and real growth for the decade.

To repeat, the moral that is supported by experience is that slowing inflation is likely to imply a temporary drag on real output and employment, a drag that in turn reflects the fact that prices and wages react to lower aggregate nominal demand only with a lag. Over the longer run, however, there seems to be no permanent trade-off between inflation, on the one hand, and employment and real growth, on the other—except to the extent that chronic high inflation may hurt real growth over the longer run.

The short-run costs of lowering inflation in terms of temporarily reduced output and employment obviously depend on all the factors that determine the degree of price and wage stickiness in the face of changing demand. One such factor appears to be the speed with which *expected* inflation adjusts in the face of aggregate demand restraint. Expected inflation is clearly important to parties negotiating prices for all kinds of longer term implicit and explicit wage, rent, and price contracts. Moreover, firms presumably make decisions on price announcements in part by considering the general price environment expected to prevail before the pricing decision must again come up for reconsideration. So if inflation expectations fall rapidly in response to weaker aggregate demand, actual inflation will also tend to fall more rapidly, and the costs in terms of temporarily reduced real output will be correspondingly reduced.

Much is made in the inflation literature of the "credibility" of the monetary authorities in their anti-inflation stance as a factor influencing the speed with which inflation expectations adjust. Optimists in this matter believe that if anti-inflation policy could be made more "credible," by one means or another, the temporary costs of reducing inflation suggested by the historical experience could be substantially reduced. Perhaps somewhat discouraging in this respect, however, is the fact that despite the presumably high anti-inflationary credibility of the Volcker years, the temporary costs in terms of "excess unemployment" of reducing inflation in the early 1980s seem to have been about average (Table 2). In a recent study of the relationship of "policy credibility" to the costs of disinflation in the *Quarterly Review*, the author concluded that

> credible disinflationary policies ... should carry a lower output cost than less credible ... disinflationary policies. Yet efforts to distinguish credible from non-credible disinflations have not met with great success. Most empirical work has not found any significant decline in the output costs of disinflation either in the United States or in the rest of the OECD throughout the early 1980s ... despite the view of many that anti-inflationary policies became more "credible" in the early 1980s.[2]

The credibility issue aside, another factor likely to affect the temporary output costs of lowering inflation is the micro structure of individual labor and product markets. In particular, price and wage stickiness seems to

[2]A. Stephen Englander, "Optimal Monetary Policy Design: Rules versus Discretion Again," this *Quarterly Review*, Winter 1991, p.78.

Table 3

Inflation and Output Growth in the 1980s

| | Descriptive Statistics | | | | | | |
| | GNP Growth | | | Consumer Price Inflation | | | Correlation between Growth and Inflation |
	Median	Mean	Standard Deviation	Median	Mean	Standard Deviation	
Low-inflation countries†	2.8	3.6	2.2	7.1	6.4	2.5	+ .09
High-inflation countries‡	2.2	1.9	1.6	32.7	76.8	87.4	− .60
All countries	2.6	2.9	2.1	9.2	37.5	67.3	− .46

† Group consists of twenty-four countries whose average annual inflation rate during the 1980s was below 11 percent. The low-inflation countries are the Group of Seven, Austria, Australia, Belgium, China, Denmark, Finland, Ireland, India, Korea, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland, Singapore, and Thailand.

‡ Group consists of nineteen countries whose average annual inflation rate during the 1980s exceeded 17 percent. The high-inflation countries are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, Egypt, Greece, Ireland, Israel, Mexico, Paraguay, Peru, Portugal, Turkey, Uruguay, and Venezuela.

be increased by the presence of monopoly or oligopoly elements in commodity and labor markets. Thus the commodity and financial markets with highly responsive prices all have characteristics that approximate the economist's model of "pure" competition.

A number of proposals have been made over the years designed to increase the sensitivity of wages and prices to changes in demand in less than perfectly competitive markets. These proposals have included making a significant fraction of annual wages take the form of profit sharing, a process that would tend to make the effective wage rate respond much more quickly to aggregate demand restraint. Another idea was the so-called TIPs proposals (tax-based incomes policies) of the 1970s that would have used the corporate income tax to penalize firms granting wage increases in excess of national productivity gains.

An inherent bias toward rising inflation

While the idea of a permanent trade-off allowing policy makers to "buy" permanent reductions in unemployment at the expense of higher inflation has been dead for some time in this country, the existence of a short-run trade-off is a fact of life, for reasons already given. A more expansive policy will accelerate the growth of output in the short run even if the longer run result is only more rapid inflation. Conversely, policies that reduce an embedded inflation are likely to slow output and employment temporarily.

Given the short-run benefits of stimulative policies, given inflation costs that come only later and that are likely to be invisible at the outset, and given, further, the short time horizon of most governments (running to the next election), governments have every incentive to favor expansionist policies even when they come at the expense of future inflation and have no long-run beneficial effects on output. At the same time, absent a real sense of crisis about inflation (such as developed in the United States in the late 1970s and early 1980s), there will be little or no political motive to encourage policies to restrain, let alone reduce, inflation.

These facts of political economy seem to be quite independent of any distinction between "liberal" and "conservative" or Republican and Democrat, but stem, rather, from the seemingly universal urge to win elections. For this reason, there seems to be in most countries a kind of built-in tension in the relationship between the central bank, charged with maintaining stability in the value of money, and the government of the day. It is hard to recall any postwar U.S. administration that did not at some point lean on the central bank to produce an easier monetary policy. On the other hand, it is hard to recall a single instance in which an administration urged the central bank to tighten policy

more than the bank itself had intended. Whatever the complex reasons, the more than fivefold rise in the price level between 1953 (the first Post-Korea and post-Treasury Accord year) and the present at least suggests the thought that monetary policy may have erred on the side of ease over the past four decades as a whole.

The political economy of the inflation problem makes it particularly difficult to get support for anti-inflation objectives in a period such as the present when core inflation has moved in a narrow range of perhaps 4 to 5 percent for several years. Such limited survey evidence as we have about longer run inflationary expectations suggests that long-term expectations are basically for a continuation of roughly this range. The evidence thus suggests that to a large degree, recent actual inflation has roughly equaled expected inflation and consequently has largely been adjusted to. The result is that current inflation is probably causing little tangible pain.

Perhaps the most convincing way to demonstrate the extent to which the economy has adjusted to recent inflation is simply to note that in 1971, a 4.0 percent inflation was thought sufficient reason to impose the truly draconian and disruptive control policies of August of that year. Yet this inflation rate was actually somewhat lower than the average inflation rate of recent experience. In stark contrast to 1971, the most recent 4 to 5 percent rate has left the problem almost invisible as a current public policy issue, at least outside of the Federal Reserve. Indeed, it is now almost impossible to believe that there was once a time when a 4 percent inflation rate could drive an administration to adopt such drastic measures as were undertaken by President Nixon in 1971.

The difficulty with a period such as the present is that, given the chronic inflationary bias of the political economy system, the longer run likelihood is that inflation will be allowed to drift up unless it is actively combated at a time when public support for such an effort is absolutely minimal.

The policy dilemma

In dealing with the ultimately severe costs of letting inflation get out of control, a society realistically has only two choices. First, given the relatively moderate *initial* costs of accelerating inflation and the political difficulties of stopping it, a society can simply allow inflation to accelerate to a level where the perceived costs (which, indeed, because of money illusion are likely to be even greater than the true costs)[3] are great

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[3]Casual observation suggests that the public does not make a clear connection between rising prices and rapidly rising money wages. They understand that rising prices cut into their purchasing power but attribute their rising wages mainly to their own real economic value. Thus they look on inflation as a pure loss of real purchasing

enough to generate political support for policies that would arrest and at least partly reverse the acceleration. These policies will always, as argued, have short-run costs. In any case, this is the approach that we, and most other advanced countries, have in fact followed. The result has been periods of accelerating inflation punctuated by recessions, with a long-run significantly positive average rate of inflation and one that, despite the better performance of the 1980s, could yet prove to be accelerating viewed over still broader sweeps of time.

The second alternative approach is to use aggregate demand policies to run the economy consistently at a level of resource utilization compatible with nonaccelerating inflation—leaving aside for the moment whether that inflation rate should be zero or some other steady rate.

Formulating the solution to the inflation problem in this way clearly raises a number of questions: Just what is the level of resource utilization "compatible with nonaccelerating inflation," (the NAIRU)? How do you measure it? What determines it? Does it change over time? What is the steady "potential" rate of economic growth that will hold resource utilization rates to sustainable levels?

These questions clearly raise difficult and complex technical problems. It does seem quite likely, for example, that the NAIRU varies over time, depending in part on demographic factors. Thus it is often argued that the rising proportion of young people and women in the labor force raised the NAIRU in the 1970s and that it has declined somewhat more recently as the female participation rate has leveled off and the baby boomers have matured. Public policies, such as the unemployment insurance systems, almost certainly also have some effect on the level of the NAIRU. It is also possible that, for reasons not well sorted out, the longer run price implications of any given rate of resource utilization (as indexed by the unemployment rate) may depend on the rate's own past history—that is, a "hysteresis" effect in which, for example, a history of high unemployment rates may somehow raise the minimum rate compatible with stable inflation rates. Some believe it is necessary to posit such a hysteresis effect to explain the roughly stable-to-rising price level of the late 1930s in the United States. This price performance was quite similar to that of the late 1920s but occurred at a time when the unemployment rate averaged over 15 percent, compared with an average closer to 3 percent in the late 1920s (Chart 6). And similar questions have been raised by the modest acceleration of European

inflation over the last three years at a time when unemployment rates, though falling, nevertheless remained dramatically higher than they had been in the 1970s, when European inflation was much lower (Chart 7).

Only somewhat less difficult problems arise in estimating a "sustainable" growth rate. To do this requires projecting population factors, labor force participation rates, the trend rate of productivity gains, and other factors.

Despite these various technical difficulties, it seems clearly better to try to move the economy steadily along a sustainable growth path than to accept the historical experience of accelerating inflation punctuated by recession. The problem is that there is no political "invisible hand" to produce such an optimal approach to policy—quite the contrary for reasons already given.

The zero inflation objective

If you start with a built-in, relatively low, and largely anticipated positive rate of inflation such as we presently have, the task of actually reducing inflation over time by perhaps 3 percentage points—from, say, roughly a 4 percent current core rate to effective price

Chart 6

Unemployment and Inflation in the United States, 1920-39
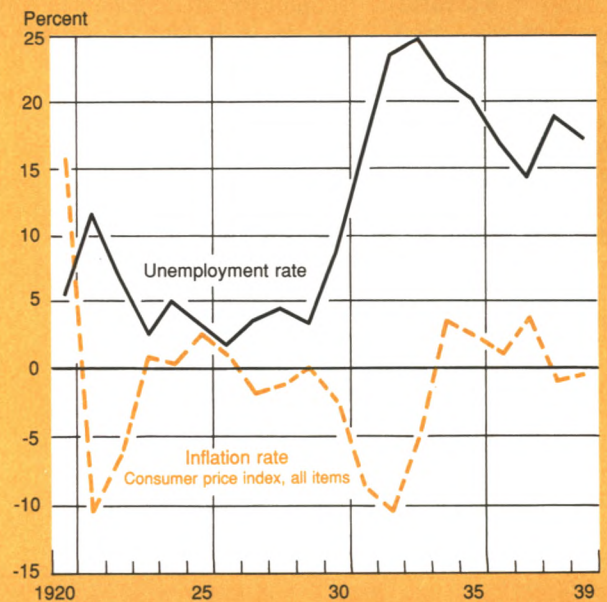
Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition, Part 1 (1975).

stability at, say, 1 percent inflation on the CPI—is clearly more difficult than merely stabilizing the current ongoing rate.

The 1990-91 recession may have somewhat reduced the dimensions of the problem. Given the slack that the recession opened up, it is quite possible that core inflation could, for the first time in many years, drop below 4 percent next year even as economic expansion resumes. Nevertheless, the past record suggests that real growth in the first year or two of recovery would have to be moderate enough to leave some margin of slack in the economy (that is, an unemployment rate somewhat in excess of the NAIRU) to eliminate the remaining gap between prospective 1992 inflation and effective price stability. The question arises whether, given the current rather low cost of an inflation rate to which the economy may have already largely adjusted, the objective of reducing inflation further to essentially zero would be worth the cost, albeit temporary, it would likely entail.[4]

In answering this question, it should be recognized that the costs of the present ongoing inflation rate, while perhaps not large, are probably not negligible either. Adjustment to inflation is not universal. For one thing, most private pensions are fixed in nominal terms so that inflation is still having significant redistribution effects. Second, important parts of the tax code still interact with inflation to produce allocative effects, including the capital gains tax and the tax on interest income. Very likely, for the reasons suggested earlier, the economy would run at least somewhat more efficiently at rates of inflation so low that "nobody needs to take inflation into account" in making decisions.

In assessments of the zero inflation objective, however, the efficiency gains of going from a largely adjusted-to 4 percent core rate to effective stability are not the most important consideration. The much more fundamental question is whether a society that does not have price stability as a goal can be expected to have the will even to stabilize an ongoing moderate inflation rate. Obviously no certain answer can be given to this question, but serious doubts are clearly justified. A governmental position that 4 percent inflation is "not a problem" suggests a government unwilling to hold inflation to 4 percent. At some level, the public probably understands this. And to the extent that such understanding makes inflationary expectations of 4 percent fragile and highly vulnerable to upward shocks, the stabilization problem becomes objectively more difficult to manage. Countries with low-inflation records such as Germany

and Switzerland have tended to be countries with a policy of price stability, not merely a policy of stabilizing some moderate ongoing rate. Thus there is a real question whether absent an agreed-upon public policy to seek outright price stability, inflation rates are not likely to creep up again at irregular intervals under the pressure of the political economy forces already described.

So there is something of a paradox here. The best inflation policy is probably one that is aimed at effectively eliminating inflation, and this policy should be publicly stated as such. At the same time, however, in the implementation of this policy it has to be recognized that there are likely to be short-run costs of reducing even a low, ongoing inflation rate to near zero and that the immediate gains will be relatively modest. An overly blunt effort to eliminate such an inflation could therefore simply cause public support to evaporate and thus prove self-defeating.

Policy rules and the central bank
The paradoxical aspects of inflation as a public policy

Chart 7

Unemployment and Inflation in the European Community, 1966-90

Percent

Inflation rate *

Unemployment rate

Source: Organization for Economic Cooperation and Development.

Note: The European Community comprises Germany, France, the United Kingdom, Italy, Belgium, Luxembourg, the Netherlands, Ireland, Greece, Spain, Portugal, and Denmark.

*Inflation is measured by the change in the personal consumption deflator.

[4]Price stability is the goal proposed in the resolution introduced by Representative Neal of North Carolina in 1989.

problem explain the perennial appeal of some kind of monetary policy "rule" that would tie the hands of the policy makers and thus insulate them from the political economy pressures that make price stability so hard to achieve in practice. Classic examples of such rules are gold or commodity standards in which the central bank is committed to buy and sell the commodity at fixed prices. Another classic example of a rule would be commitment to a fixed rate of growth in some suitably defined measure of the money stock. In recent years various academics have proposed more complex rules that incorporate "feedback" provisions allowing for some automatic but temporary accommodation of short-run shocks such as an oil price increase or "autonomous" shocks (up or down) to aggregate demand.

Debate and analysis of such policy rules have spawned a huge literature over the years but have attracted little or no public support for them. There are, in fact, some obvious problems with such rules. Rules that are relatively simple to understand and adhere to, such as the fixed money growth proposal, tie the government's hands in coping with short-run problems—problems that may in fact last long enough to have significant political repercussions. The more complex rules with feedback provisions could, in principle, provide more flexibility to deal with such problems but run the risk of being too complex both in theory and practice to generate public understanding, support, and confidence.

Moreover, most if not all of these rules have serious technical problems. Thus a fixed money growth rule will work well only if the demand for money is reasonably stable and reasonably insensitive to changes in the average level of interest rates and to changes in interest rate differentials. But the financial innovation and deregulation of the 1970s and 1980s produced major changes in the nature of the instruments counted in the money stock measures and seem to have produced significant shifts in money demand while leaving it quite sensitive to volatile shifts in the public's demand for different kinds of financial assets, to short- to medium-term movements in the average level of interest rates, and to shifts in relative rates. Perhaps most fundamental, the same political economy pressures that produce the paradoxes of the inflation policy problem in the first place might ultimately lead to erosion or outright abrogation of any policy rule that bound monetary policy to some fixed course of action.

The second consequence of the inflation policy paradox is that it makes the case for a strongly independent central bank. The reasoning requires no great elaboration. To the extent that the central bank can be insulated from the government of the day, it can be insulated from the political economy pressures that make economies inflation prone. Needless to say, it is impossible to imagine any system in which the independence of the central bank could or should be absolute or in which it could or should pursue policies fundamentally at variance with prevailing public opinion. But insulation of the bank from immediate political pressures seems likely to be a necessary condition for a reasonably noninflationary environment in most countries.

Conclusion

Inflation poses real costs, and even dangers, to a stable economy and society. When inflation is low and the economy has largely adjusted to it, these costs do not loom large relative to many other public policy issues. But ultimately, at some level, inflation becomes not merely an economic cost but a threat to stability. Therefore, inflation *must* be contained, and the only real questions are, at what level and by what means? Because the costs of low and largely anticipated inflation are relatively small, and because the temptation to exploit short-term trade-offs is strong, an effort is needed merely to *keep* inflation at low levels and thus to avoid the pattern of accelerating inflation punctuated by recession that we have experienced in the postwar period.

It is at least questionable whether a policy of simply *containing* inflation at a low level is ultimately credible. If it is not, there is a strong case for stating and working toward a policy of outright price stability. But such an objective must be pursued cautiously, lest short-run costs prove unacceptably large.

There is no "permanent" solution to the inflation problem. Instead, inflation is likely to have to be attacked anew through each turn of the political wheel. The most favorable environment for dealing with the problem can be created by maximizing the independence of the central bank and by stating as forcefully and clearly in law as possible that the bank's primary objective is effective price stability. These are in no sense magic solutions. They are merely the best way to improve the odds for success.

In Brief Economic Capsules

An Overview of Inflation Measurement

by David Brauer and Lucille Wu

The measurement of inflation—the rate of change in the aggregate price level—requires the construction of price indexes. In this article we survey a variety of indexes compiled and published by the government. We identify differences in the construction and coverage of these measures and touch on some of the issues affecting the measurement of prices for a broad range of goods and services. A companion article by Eugene Kroch in this issue of the *Quarterly Review* focuses more directly on the problems of measuring inflation in the service sector.

Inflation measurement would be a trivial matter if the prices of all goods and services increased proportionally. In fact, however, relative prices are continually shifting. For this reason, any real-world inflation index (a weighted average of the rate of increase or decrease in the prices of various goods and services) is imperfect.

With any price index, one wishes to compare the prices of *identical* goods and services over time. Difficulties can arise when the exact nature of a product changes—for example, as a result of improvements in the product's quality. The quality issue is probably deeper for many categories of service spending, such as health care, than for goods.[1] Quality corrections are less common in services than in goods, leading to the suspicion that service inflation rates may be overstated.

The most commonly used type of price index is a Laspeyres, or fixed-weight, index, which measures the current cost of purchasing the initial (base) period basket of goods and services. Such an index fails to account

for those shifts in spending patterns due to changes in relative prices. Consequently, Laspeyres indexes like the consumer price index (CPI), producer price index (PPI), and the fixed-weight index for gross national product (GNP) are usually believed to overestimate the rise in the "cost of living"—that is, the loss in "utility" or well-being resulting from an increase in the price level.

Any fixed-weight index will lose some of its accuracy as the interval between the base and current period increases and the weights used become outdated. In addition, because a fixed-weight index only includes commodities that appear, and can be priced, in every period, information about both new products and those that have become obsolete is lost.

Alternatively, a Paasche index measures the cost of purchasing the *current* period's basket of goods and services at base period prices. This type of index, exemplified by the implicit GNP deflator, is not a pure price index, because it encompasses the interaction between price and quantity changes. A Paasche index can usually be said to understate inflation, since it will be reduced when consumers shift their spending patterns in response to rapid increases in the prices of some items.

Specific inflation measures
The consumer price index[2]
The CPI, the most widely used measure of inflation, was

[1]See Eugene Kroch, "Tracking Inflation in the Service Sector," in this issue of the *Quarterly Review.*

[2]Much of the information in this section and the next is based on U.S. Department of Labor, Bureau of Labor Statistics, *BLS Handbook of Methods*, Bulletin no. 2285, April 1988. Some of the sample sizes cited in this publication have been subsequently changed.

first introduced during World War I to calculate cost-of-living adjustments for wages. Today, in addition to the escalation clauses in collective bargaining agreements, provisions to adjust future payments based on changes in the CPI can be found in Social Security and other federal programs, rental contracts, insurance policies, and royalties, as well as alimony and child support payments. In 1985, to prevent inflation-induced "bracket creep," the federal income tax structure was indexed to the CPI.

The CPI, which is compiled and published by the Bureau of Labor Statistics, measures the average change in prices of a fixed market basket of goods and services purchased by urban consumers. The market basket covers seven major categories of expenditures: food, housing, apparel, transportation, medical care, entertainment, and other goods and services. Prices are collected in eighty-five urban areas from about 19,000 retail establishments and approximately 35,000 tenant-occupied and 27,000 owner-occupied housing units. Prices for food, energy items, rent, and a small number of other goods and services are compiled monthly in all eighty-five locations. Prices of most other items are gathered every month in the five most populous geographic areas. In the other urban areas they are gathered every other month. Overall, about 95,000 prices are collected each month. In addition, information on rents is collected each month from one-sixth of the rental units and one-twelfth of the owner-occupied housing units in the sample. Most price data are obtained directly through visits or telephone calls by trained representatives of the Bureau of Labor Statistics.[3] Some secondary sources (that is, government agencies and trade publications) are consulted for items such as used cars, electricity and natural gas, local telephone charges, airline fares, and intercity bus and train fares.

The composition of the market basket of consumer goods and services is derived from expenditure data collected by the ongoing Consumer Expenditure Survey. The data reflect people's buying habits: what type of goods and services consumers are buying and how much they are spending on each item. Expenditure patterns are estimated from the survey data for a base period. The base period spending patterns constitute the fixed market basket of goods and services whose average price change the CPI is designed to measure. The current index base period is 1982-84. Approximately once every ten years, the base period is revised to bring the consumer spending pattern in the index closer to the changing reality.

Besides the periodic revisions of expenditures for the fixed market basket of goods and services, various forms of improvements and changes have been introduced in the construction of the index over time. The most significant conceptual revision involved the treatment of home ownership costs. Before 1983, the index implicitly measured the cost of owning a house rather than the cost of consuming housing services. Under this approach, home purchase prices and mortgage interest rates figured importantly in the housing component. In fact, movements in this component were often dominated by movements in mortgage rates and, therefore, by movements in long-term interest rates in general.

Since the CPI is a measure of the "cost of living," the more appropriate concept is the cost of consuming housing services. For this purpose, rental cost (explicitly, or, in the case of homeowners, implicitly) is the relevant "price." Thus, the revised approach involves estimating the cost of renting a house. The assumption is that homeowners incur an opportunity cost by living in, rather than renting out, their houses. This revision has had the effect of substantially reducing the weight of homeowners' costs in the CPI.

While the treatment of homeowners' costs has been improved, other problems with the CPI relating to item substitution and quality adjustments remain. The difficulties of isolating price changes caused by quality differences and of pricing a new substitution often complicate price assessments for components such as apparel and medical care.[4] To address quality changes and other problems, special procedures are used to compile price information for new cars, used cars, automobile finance charges, health insurance, quantity discounts, and bottle deposits. In addition, adjustments are made for pricing practices such as bonus merchandise, utility refunds, manufacturers' rebates, and cents-off coupons so that the index measures actual out-of-pocket spending by consumers. These special procedures cannot correct for all problems, however.

Some critics also question whether taxes are treated appropriately in the CPI. The coverage of taxes in the CPI is fairly broad but not fully comprehensive. The CPI measures actual prices paid by consumers, prices that may include sales, excise, utility, or gasoline taxes. Real estate taxes are not explicitly included as part of the cost of housing services in the CPI. They are indirectly taken into consideration, however, through their effect on residential rents, both for renters and as part of "owner's equivalent rent." Income taxes, which are independent of consumer spending on goods and services, do not in any way enter into the CPI.

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[3]For a good description of some of the procedures used by these representatives, see "How Reliable is the Consumer Price Index?" *Business Week*, April 29, 1991.

[4]See Kroch, "Tracking Inflation."

In recent years the rate of inflation based on the CPI for all items has fluctuated around an average of about 5 percent. This rate is somewhat greater than the inflation rate of around 3 to 4 percent between 1983 and 1986 but substantially lower than the rate before the 1982 recession. As Chart 1 illustrates, the rate of inflation in the CPI for all items is quite volatile from quarter to quarter. This is largely due to the inclusion of food and energy in the CPI. The "core rate" of inflation, which excludes those two items, has been quite stable at around 4 to 5 percent since 1983, although it showed a slight upward trend in the last two years before turning down in the spring of this year.

The producer price index
The PPI is an index measuring prices paid to domestic goods producers, excluding indirect taxes. The PPI is classified by stage of processing, with separate measures for finished goods, intermediate goods, and crude materials. Finished goods are defined as those ready for sale to a final user (household or business). Crude materials are those entering the market for the first time. Any good that meets neither of these definitions is classified as an intermediate good.[5] In addition, the PPI is reported for a large number of specific products or

[5]It is possible for some items to be counted more than once at the intermediate stage.

groups of products. The most closely watched measures are the PPI for all finished goods and the PPI for finished goods excluding the volatile food and energy components. The PPI for crude materials has received some attention as a long-lead indicator of inflation.

The PPI is a fixed-weight index, with weights based on the value of shipments reported in the 1982 censuses of manufacturing, agriculture, and minerals. The 1982 weights were incorporated beginning in January 1987. Data are collected through a survey of business establishments, with participation voluntary. Reported figures are subject to revision four months following initial publication, although in practice these revisions are usually minor. Seasonally adjusted figures are revised each January.

The PPI as it is currently calculated has several problems. Because it covers only domestically produced goods and excludes both services and imported goods, its usefulness as a leading indicator of consumer price inflation is limited. As a fixed-weight index, it fails to account for changing expenditure patterns

Chart 1

Comparison of Consumer Price Index Inflation Indicators

Quarterly Percent Change at Seasonally Adjusted Annual Rates

Chart 2

Comparison of Producer Price Index Inflation Indicators

Quarterly Percent Change at Seasonally Adjusted Annual Rates

Note: Second-quarter figures are based on data available as of August 9, 1991, and are subject to revision.
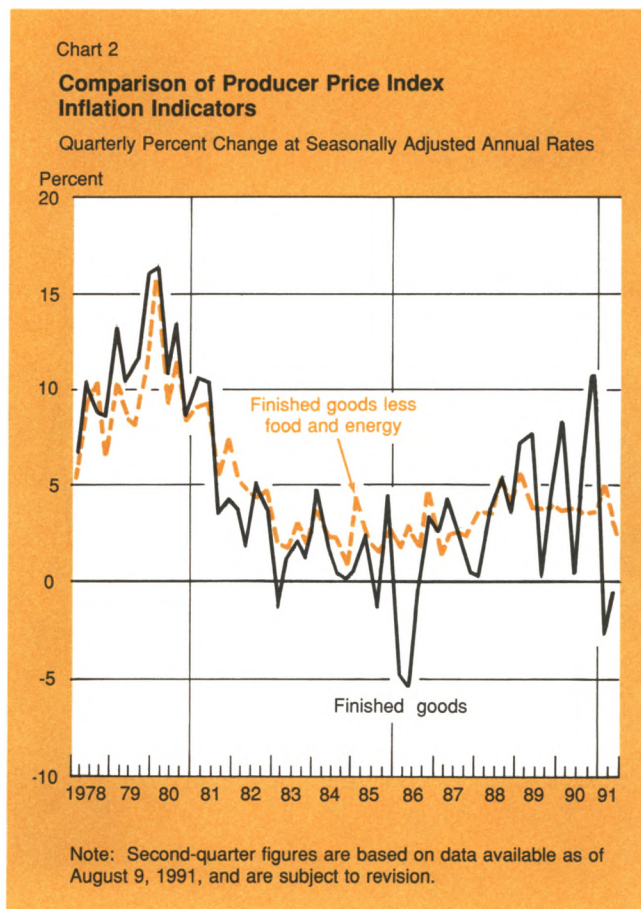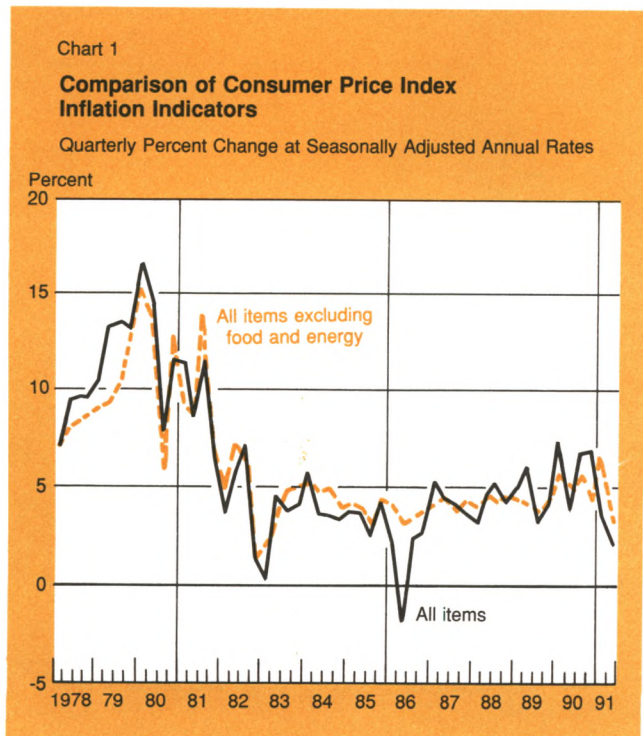
over time, tends to track obsolete models for too long, and introduces new ones too slowly. In addition, the use of weights obtained from surveys taken in a recession year means that, in the PPI's current form, cyclically-sensitive goods are underrepresented. Respondents are supposed to report actual transaction prices, but some may in fact report only the list price of an item without adjusting for special sales, discounts, or manufacturers' rebates.

Recently the rate of inflation in the PPI for finished goods has been very volatile from quarter to quarter (Chart 2). As in the case of the CPI, this volatility is due to the inclusion of food and energy. When oil prices rise sharply, as they did in the fourth quarter of 1989 and in the third and fourth quarters of 1990, producer price inflation tends to accelerate dramatically. Likewise, declining oil prices yield a sharp deceleration in PPI inflation (or even a negative rate of inflation, as in 1986 and the first quarter of 1991). Excluding the volatile food and energy components, producer prices of finished goods have risen at an annual rate of about 4 percent over the past few years.

Inflation measures based on the GNP accounts

The inflation measures in the National Income and Product Accounts are byproducts of the construction of real GNP.[6] One such measure is the implicit GNP deflator, which is simply the ratio of nominal GNP to real GNP. It is basically a current period weighted average of all price indexes used to estimate the individual components of real GNP. For each category, weights reflect current period final demand (as well as inventories) as a fraction of current GNP. The GNP deflator theoretically covers only domestically produced goods and services. Import prices, however, are implicitly reflected in the deflators for various components of gross domestic purchases, then explicitly subtracted in calculating the overall deflator.

[6]For a more detailed description of the National Income and Product Accounts (NIPA), see Carol S. Carson, "GNP: An Overview of Source Data and Estimating Methods," *Survey of Current Business*, July 1987, pp. 103-26; "The U.S. National Income and Product Accounts: Revised Estimates," *Survey of Current Business*, July issues, 1988 and subsequent years; NIPA Methodology Papers nos. 3,4,5, and 6; and Allan H. Young, "Alternative Measures of Real GNP," *Survey of Current Business*, April 1989, pp. 27-34.

Chart 3

Comparison of Gross National Product Price Measures

Quarterly Percent Change at Seasonally Adjusted Annual Rates

Note: Second-quarter figures are based on data available as of July 26, 1991, and are subject to revision.

Chart 4

Comparison of Three Major Inflation Indexes

Quarterly Percent Change at Seasonally Adjusted Annual Rates

Note: Second-quarter producer price index and gross national product figures are based on data available as of August 9, 1991, and are subject to revision.

Since the weights vary from quarter to quarter, changes in the implicit deflators for GNP and its components reflect not only price movements but also changes in the mix of goods and services. The more conventional fixed-weight price index for total GNP and selected components is calculated from the same set of detailed price indexes. Changes in both the fixed-weight price index and the implicit deflator can be seen in Chart 3, which illustrates the effects of different weights on the movement of the two price measures. The fixed-weight indexes are close counterparts of the CPI; the index for personal consumption expenditures covers mostly the same items as the CPI and assigns them similar weights. The currently published fixed-weight GNP price index uses weights based on the 1982 composition of goods and services. The forthcoming comprehensive revision of the accounts, scheduled for this November, will recalculate real GNP using 1987 prices.

The wide variety of individual price indexes used in estimating constant dollar GNP components includes a large number of CPI series, accounting for 82 percent of total personal consumption expenditures in 1982. Other government-published price indexes such as PPI, export and import price indexes, and price series from trade sources are also used in the process of deflating. Several special price indexes for components such as computers and defense purchases are constructed by the Bureau of Economic Analysis. The indexes for computers and peripheral equipment, originally developed by IBM, are adjusted for quality changes based on such characteristics as speed and capacity.

* * *

Chart 4 illustrates the path of three major measures of inflation—the CPI for all items, the PPI for finished goods, and the GNP fixed-weight index—since 1978. On average, the three measures have in recent years yielded similar inflation rates, but the GNP fixed-weight index is much smoother than the others. The PPI is especially volatile because it covers only goods prices, with energy prices playing a prominent role. The CPI is somewhat less volatile since it includes service prices as well as goods prices, but it is still influenced by both energy prices and the value of the dollar.

Tracking Inflation in the Service Sector

by Eugene Kroch

Measured inflation rates for services have exceeded goods inflation rates in all but three years since 1949.[1] Some of these years saw goods prices declining, but at no time did service prices fall. Although the gap between these two rates of inflation has narrowed in recent years, service prices have continued to advance at a significantly faster pace than goods prices (Chart 1). One might seek an explanation for higher services inflation in demand pressures or slow productivity growth; this essay, however, focuses on the possible role of measurement bias.

The first section surveys the methodologies used to measure prices for various classes of services. It demonstrates how the design of these methods might contribute to the overstatement of price increases. The second section focuses on inflation measurement in three key service categories: housing, medical, and educational services. Evidence is presented that upward bias exists in the measurement of inflation rates for medical services and possibly for educational services. In addition, housing services inflation appears to have been overstated in the last year or two, but the extent is hard to judge because of the difficulties in separating the consumption and investment dimensions of home sale prices.

Measurement methods

Errors in measuring service sector inflation arise frequently because of the difficulty of identifying standard output units for many categories of personal services, such as medical care, entertainment, and education. As a consequence, quality and productivity improvements are often lumped into price changes, more often than not exaggerating price increases. By contrast, price changes are easier to isolate in many services that distribute goods, such as transportation and utilities, because they have standard output units much like commodities. For transportation the units of service are either passenger-miles or ton-miles; for utilities they are volumes—gallons of water supplied, for example, or cubic feet of natural gas delivered. Nonetheless, some of the service categories that are distributive, such as communications and trade, still suffer from the type of measurement problem that affects personal services.[2]

Service inflation is monitored at two junctures: at the point of final demand, as reported in the consumer price index (CPI) and in the service components of the deflators for GNP expenditures; and at the point of production, as reported for each industry in the gross product originating (GPO) accounts.[3] In recent years, service inflation at the industry level has been about a percentage point lower than service inflation at the point of personal consumption (Chart 2), largely because a greater share of GPO consists of distributive services (whose inflation rates are lower and closer to those of goods than are the inflation rates of personal services). Still, the two inflation measures do move

[1] The three exceptional years are 1973, 1974, and 1979, all of which are associated with oil price shocks.

[2] Telephone communications can be measured in message units. Broadcast communications, however, are measured by advertising revenue. This treatment of broadcasting makes sense in many ways, but it does not permit price and quantity to be disentangled.
Retail and wholesale trade can be measured by the real value of the commodities sold, but this approach does not account for changes in the value to consumers of retail amenities and selection diversity. See Martin N. Bailey and Robert J. Gordon, "The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power," *Brookings Papers on Economic Activity*, 1988:2, pp.347-420.

[3] A description of the GPO accounts and their recent revision is given by Frank De Leeuw, Michael Mohr, and Robert Parker, "Gross Product by Industry, 1977-88: A Progress Report on Improving the Estimates," *Survey of Current Business*, January 1991, pp. 23-37.

together.[4]

Techniques for measuring inflation in services take one of three forms: (1) recording charges per customer serviced or per specific unit of service, (2) using an index of employment earnings associated with the service, and (3) imputing output prices on the basis of employment extrapolation and other indicators.

The first of these approaches mimics the methodology used to compute the goods components of the CPI. In addition to the transportation and utility service measures already cited, examples include room rates for hotels, amusement admission prices, and fees for standard professional services such as routine doctor visits. A major problem with many of these measured prices is that the particular items priced are often too specialized to accurately represent price movements in the larger service category to which they belong. For example, the CPI uses the price charged for preparing a "short-form" last will and testament as an indicator of the price of legal services in general.

The second approach, inferring prices from an index of the earnings of workers providing the service, is used when no standard charge can be constructed, as is the

case for most professional, personal, and educational services. The earnings index is also used to supplement direct price measurement, especially when the prices recorded represent only a small portion of the service category. Of course, earnings indexes will tend to exaggerate inflation by ignoring labor productivity gains.

The third approach includes a variety of strategies for imputing service output prices from nonwage indicators. One such device, applied to a number of business services, is to infer the price of the service by dividing the industry's nominal gross product by a real value estimated from an index of employment. Like the use of an earnings index, however, this procedure does not account for labor productivity growth. Another strategy, used for certain financial services such as commercial banking, bases price movements on the differentials between bank lending and borrowing rates. The disadvantage of this method of imputation is that the reported price of banking services increases whenever lending rates rise relative to borrowing rates.

Granting that each of the price-measurement methods described above is flawed does not necessarily lead to the conclusion that aggregate inflation measures such as the CPI and the GNP deflator are substantially biased. Many services that are hard to price—financial, legal, and business services, as well as retail and

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[4]During the 1980s, distributive services constituted more than 25 percent of GPO services but less than 10 percent of consumer services.

Chart 1

Inflation Rates for Consumption Goods and Services

Average Annual Growth in Consumer Price Index

Chart 2

Inflation Rates for Services

Average Annual Growth in Prices

Note: The Bureau of Economic Analysis' Gross Product Originating (GPO) Accounts provide no reliable inflation rate for 1977.
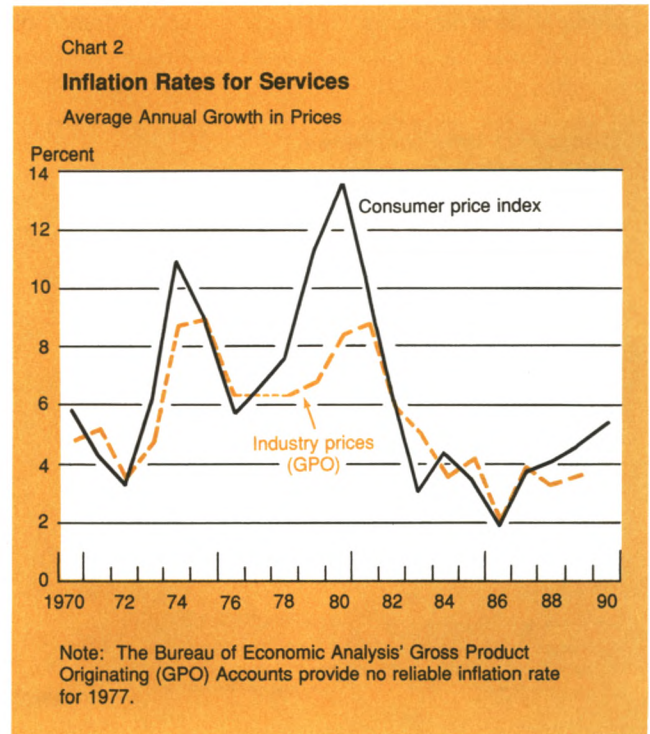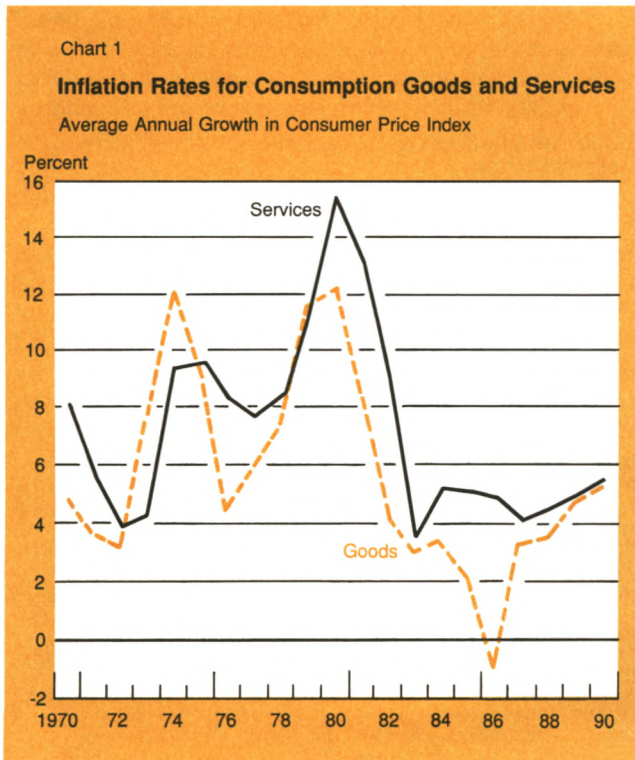
wholesale trade—are primarily intermediate inputs in the production of goods and other services. As long as final demand prices can be observed directly and independently, they are not biased by errors in measuring intermediate input prices. Nevertheless, errors in pricing those services that are elements of final demand, such as housing, medical, and educational services, may lead to errors in aggregate inflation measures.

Examining specific service categories in the CPI

The table disaggregates CPI inflation rates by service category and compares them with overall goods inflation over the past two decades. The first column gives the budget shares, based on the 1982-84 consumer survey, of each category used in constructing the CPI. By far the most important component is rent of shelter, which accounts for about half of all consumer services; not surprisingly, shelter inflation closely parallels overall services inflation. Medical care and education services show the highest inflation rates; price increases in these categories appear largely independent of movements in the overall CPI. Since the early 1980s, transportation and entertainment prices have also increased somewhat faster than the overall inflation rate, but their movements appear to follow the pattern of the CPI. These comparisons suggest that housing services are key to understanding consumer services inflation and that medical and educational services should be examined for upward bias.

Medical care services make up about 4 percent of the consumer budget and are measured by private payments to physicians, dentists, and other medical professionals, and to hospitals and sanitariums.[5] Prices are based on physicians' fees, dental fees, and hospital daily service charges. The *Handbook of Methods* issued by the Bureau of Labor Statistics acknowledges that a major deficiency of the medical care component of the CPI is the difficulty of adjusting for quality improvements. For example, hospital room modifications, changes in the nurse-to-patient ratio, and the introduction of new equipment are all likely to contribute to the price of a day's stay in a hospital. Even though these changes in treatment affect both the quality and the quantity of medical service, the Bureau of Labor Statistics records the fee changes as pure price inflation. Upward bias of this kind is surely part of reported medical care inflation, but its magnitude is difficult to gauge.

A significant degree of positive bias in reported medical service inflation is suggested by the much lower inflation rates for medical equipment, an input in the production of medical services. One reason for this slower price increase is that the Bureau of Economic Analysis adjusts the equipment series for quality changes. Hence, one way to adjust medical services inflation is to extend the Bureau of Economic Analysis' quality adjustment for medical equipment to the medical services that use the equipment. The adjustment is based on the observation that if medical equipment prices were *not* quality adjusted, they might well rise at the same rate as prices of medical services.[6] The effect of the quality adjustment on equipment prices could be inferred as the difference between the two series. This difference when multiplied by the share of value added attributable to medical equipment would be a suitable adjuster for medical services inflation. Chart 3 shows such an adjusted series, together with CPI medical services inflation and medical equipment inflation. The consistently lower inflation rate for medical equipment throughout much of the 1980s implies that the upward bias in medical services inflation might have been as high as 1 percentage point per year during that period.

Consumer Inflation Rates
(Average Annual Percentages)

	Budget Shares	Inflation Rates		
	1982-84	1970-90	1982-86	1986-90
CPI		6.3	3.2	4.5
Goods	48.6	5.5	1.9	4.1
Services	51.4	7.1	4.7	4.8
Rent of shelter	25.7	—	4.7	4.9
Renters' cost	7.5	—	5.1	4.7
Owners' equivalent	18.2	—	4.5	4.9
Other household†	9.5	—	3.1	1.9
Transportation	6.2	6.8	4.9	5.5
Medical care	4.0	8.5	7.1	7.5
Entertainment	2.2	5.9	5.4	5.2
Education	1.6	9.1	9.3	7.3
Other personal‡	2.2	5.5	4.1	4.2

†Includes household utilities and public services, housekeeping services, maintenance, repairs, and insurance services.

‡Includes personal care, legal, funeral, financial, and apparel services, each of which makes up less than one-half of 1 percent of the consumer budget.

[5]Almost two-thirds of health care services in the U.S. economy are not part of the consumer budget because they are provided through employer-paid health plans. Hence, medical care prices are given only a 4 percent weight (including household payments for health insurance) in the CPI, even though household consumption of health services accounts for more than 12 percent of personal consumption in the National Income and Product Accounts.

[6]Evidence from the CPI supports this supposition, since the CPI for medical goods (largely pharmaceuticals, which are also not adjusted for quality changes) has been rising about as fast as the CPI for medical services. See Peter Rappoport, "Inflation in the Service Sector," *Federal Reserve Bank of New York Quarterly Review*, vol. 11, no. 4 (1987), pp. 35-45.

Educational service prices, consisting of private tuition and fees, have risen faster than any other category of services over the past two decades. Although they represent only 1.6 percent of the 1982/84-based budget used to compute the CPI, educational services today account for more than 3.5 percent of (nominal) purchases in the current CPI budget. Almost two-thirds of these expenditures go to higher education. Prices are based largely on the labor earnings index for educators. They contain no adjustment for quantity and quality changes, reflecting the Bureau of Labor Statistics' view that education is labor intensive and that opportunities for labor productivity gains are limited.

The accuracy of the educational services inflation series can be assessed in at least two ways. One is to compare the series with other price indexes for education. The other is to compare it with the growth rates of tuition and fees per student. Chart 4 compares the consumer price series for education services with the "Higher Education Price Index" compiled by Research Associates of Washington and with the U.S. Department of Education's data on higher education tuition

payments per full-time-equivalent student. During the 1980s the first series shows lower inflation rates than the CPI series for educational services. The growth rates of tuition per student, however, closely track the CPI's inflation rate for education services. Still, since tuition increases have outstripped the higher education price index, the growth in tuition costs may in part reflect higher levels of education services. On balance, the evidence supports the claim that in recent years the CPI's inflation rate for education services has been somewhat upwardly biased.

The single largest component of the CPI is *rent of shelter*, accounting for 26 percent of consumer expenditures. Most of this component (18 of the 26 percent) represents imputed rent of homeowners, which by definition is not observed directly. Hence, CPI movements are strongly influenced by the procedure for estimating prices for housing services. Under current procedures, little of the leveling-off or decline in housing prices over the past two years has been reflected in the CPI.

Before 1983, the CPI used data on housing prices and mortgage interest costs to calculate homeowners' shelter costs.[7] This "asset price" approach to homeowner

[7] The precise technique can be found in *CPI: History and Techniques*, U.S. Department of Labor, Bulletin no. 1517, 1966.

Chart 3

Medical Services Inflation

Average Annual Growth in Prices

*Source: U.S. Department of Commerce, Bureau of Economic Analysis, Fixed Reproducible Tangible Wealth in the U.S., 1925-85, June 1987 and 1990 update.

Chart 4

Educational Services Inflation

Average Annual Growth in Prices

Notes: Values for tuition per full-time-equivalent student are enrollment-weighted averages of private and public higher education charges. These values are computed from data in U.S. Department of Education, National Center for Education, Digest of Economic Statistics. Values for higher education price index are drawn from Research Associates of Washington, Higher Education Prices and Price Indexes, Washington, D.C., 1989.

Chart 5

Housing Price Inflation

Growth from Four Quarters Earlier

Percent

Rental price index
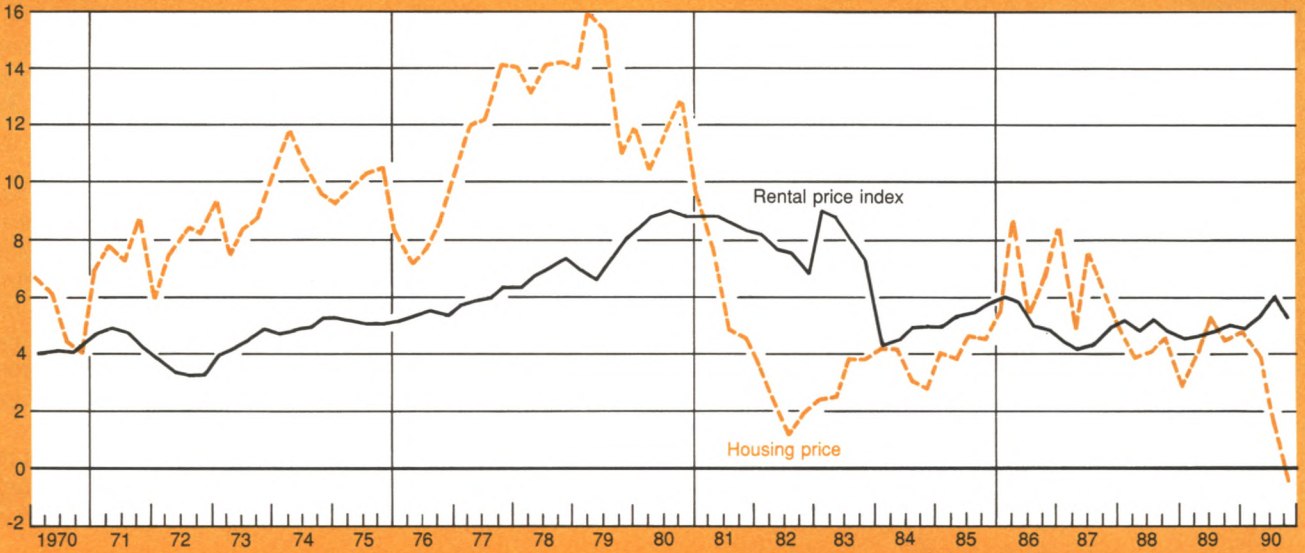
Housing price

Note: Housing price movements are based on the median sales price of existing single-family homes reported in National Association of Realtors, Homes Sales.

Chart 6

Consumer Price Inflation

Growth from Four Quarters Earlier

Percent

Alternate consumer price index

Consumer price index

costs was criticized for failing to distinguish the investment element of homeownership from the consumption value of dwelling in the home. Because the CPI is designed to measure the average change in prices paid for consumption goods and services, investment purchases should be outside its scope. A house is a long-lived asset, but it also provides the owner with a flow of services over time. The cost of the shelter service provided by the asset is the conceptually correct measure for the CPI.

In 1983 the homeownership component was replaced with "owners' equivalent rent." The idea is to attribute to homeowners the rental income they forgo by occupying the units themselves rather than renting them out. The estimates of owners' equivalent rent used in the CPI are calculated by asking homeowners how much their houses would rent for and adjusting the responses to data on actual rental rates.[8] The problem with this procedure is that the rental market is small relative to the sales market for single family homes; hence, it does not provide a reliable way to separate the consumption element from the investment element of owning a home. An alternative approach is to use home sale prices as an indicator of the cost of housing services, on the grounds that these prices are driven, at least in part over the medium term, by the demand for shelter services.

Chart 5 compares movements in the CPI's rental price index for housing services with movements in an index of housing prices, the median sales price of existing single family homes. As the chart shows, the asset price series is more volatile. The correlation between the two series is essentially zero, suggesting that the rental price index reflects little or nothing of the contemporaneous movement in housing prices. Before 1980, housing prices rose consistently faster than rents; during the past decade both indexes rose and fell, but frequently in direct opposition to each other. More important, the decline in housing prices since 1987 appears to have had little effect on rental prices, implying that rental price movements only weakly reflect changes in the demand for housing.

To see how much of a difference changing the treatment of housing makes in the CPI, we can compare two versions of the CPI: one using housing prices and the other using owners' equivalent rent. For the period 1967 to 1983 the Bureau of Labor Statistics offers both series: the CPI-U, using housing prices, and the experi-

mental CPI-U-X1, using rental rates. For the period since 1983 we construct an alternative index to the official CPI, replacing the owners' equivalent rent by a housing price measure.[9]

Chart 6 shows the results of this exercise. In general, the alternative measure of consumer prices (using housing prices) tracks the CPI fairly well, but there are significant exceptions. For the most part these exceptions occur when housing prices exhibit sharp and sustained movements in one direction or the other, increasing the amplitude of the inflation cycle.

The comparison between the standard and alternative CPI measures shows that at times the cost of housing services reported in the official CPI does not reflect movements in house prices. Rental rate inflation fluctuates less than home price inflation, and rents tend to lag behind sales prices. In recent years the failure of rental inflation to reflect the softening in the housing market might indicate that the housing component of the CPI is overstating the inflation rate of housing services. But such an inference ignores the possibility that recent declines in home sale prices are purely the consequence of those changes in the asset value of housing that follow, say, the breaking of a speculative bubble. Of course, if part of the housing price decline does reflect changes in the value of the shelter services provided by the asset, then CPI housing services inflation could be said to be exaggerated. Still, this upward bias would be hard to quantify, since it depends on the extent to which the changes in home sales prices reflect shifts in the value of housing services as opposed to changes in the perceived value of holding wealth in the form of housing assets.

Conclusions

Some methodologies for inferring prices of consumer services tend to overstate price increases. This tendency is seen in the measurement of prices in three key categories of consumer services. Medical services inflation appears to be exaggerated; so too is educational services inflation, although the evidence is weaker. In the last year or two housing services inflation appears to have been overstated, although the magnitude of the bias is uncertain. These observations together suggest that consumer services inflation may in reality be significantly lower than the measured rate and somewhat closer to consumer goods inflation.

[8]For a detailed discussion, see U.S. Department of Labor, "Changing the Homeownership Component of the Consumer Price Index to Rental Equivalence," *CPI Detailed Report*, January 1983, pp. 7-13.

[9]The alternative CPI that we construct for the period starting in 1983 includes housing prices, as does the official CPI for the preceding period, but not mortgage interest rates.

Recent Real Income and Wage Trends in the United States

by Eugene Kroch

The decade of the 1980s has been described as one of the longest and most impressive periods of uninterrupted growth in U.S. history. From the cyclical peak of 1979 through 1989, real GNP grew almost 3 percent per year; from the recession of 1982 through 1989, it grew an impressive 3.5 percent per year, a rate not seen over such a long period since the 1960s boom. Nevertheless, a number of analysts have suggested that these aggregate income growth rates are misleading indicators of how well the typical worker or household fared. Concern is especially great because during the 1980s real wages stagnated in the United States while they grew robustly in some of our major industrialized trading partners, such as Japan, Germany, and the United Kingdom.

Those who question whether living standards in the United States improved over the last decade note that real wages and salaries did not keep up with broader measures of real income. This article investigates this divergence by presenting the relevant real income and wage measures and by examining the economic factors underlying their movements. The most important of the trends considered are the increase in labor force participation, the rise in the share of income from nonlabor sources, and the decline in the real wages of nonsupervisory or production workers.

Contrasting income trends
Much confusion about U.S. real income trends arises from imprecise use of income measures and inappropriate comparisons of time periods. First, nominal income measures should be deflated by a common price index that reflects the purchasing power of income. Consumption-based deflators such as the consumer price index (CPI) are suitable for this purpose, but the specific choice of index makes very little difference. All the

usual indexes are derived from the same underlying Bureau of Labor Statistics (BLS) data and differ only marginally in the weights chosen to average price relatives. Second, secular trends should be isolated from business cycle movements. Comparing 1989 developments with the 1979 and 1973 peaks is informative, whereas comparing these same developments with the 1982 trough could be misleading. Third, not all income series have the same coverage or can be associated with comparable population groupings. Income series reported by the Commerce Department's Bureau of Economic Analysis (BEA) are not directly comparable with income measures compiled by the Census Bureau's Current Population Survey (CPS). BEA personal income includes income from all sources, while CPS income includes only money income.[1] Moreover, the BEA reports only aggregate income, whereas the CPS money income data are available for households, families, and individuals with income.[2]

Differences in the growth rates of alternative income measures can often be traced to the breadth of their coverage. The narrowest income measure discussed in this article is annual wages and salaries per worker for the entire work force, as reported in the National

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[1]Money income leaves out all forms of nonpecuniary income, such as employment fringe benefits and in-kind transfers (food stamps, medicare, medicaid). It is defined as "the algebraic sum of money wages and salaries, net income from self-employment, and income other than earnings." This last category includes transfer payments such as pensions, public assistance, unemployment insurance, and workmen's compensation, as well as unearned income on savings and investments and rents and royalties.

[2]For a valuable discussion of the differences in income measures, see Paul Ryscavage, "Reconciling Divergent Trends in Real Income," *Monthly Labor Review*, July 1986, pp. 24-29; and, by the same author, "Understanding Real Income Trends: An Analysis of Conflicting Signals," *Business Economics*, January 1989, pp. 36-42.

Income and Product Accounts (NIPA). A somewhat broader measure of labor income is the NIPA series on total compensation per worker, which includes the cost of nonpecuniary fringe benefits such as employer-provided health plans.[3] Since 1979, when the BLS's Employment Cost Index began keeping track of nonwage and salary compensation, fringe benefits have grown at least 20 percent faster than wages and salaries each year. The broadest measure of income is the NIPA's personal income, which adds proprietors' income, dividends, rents, and transfers to compensation, but subtracts employer contributions for social insurance.
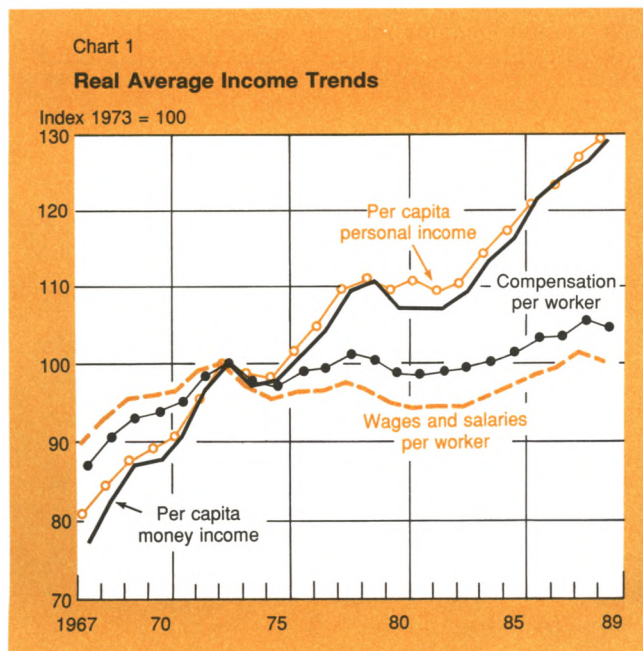
Using consistent standards of comparison helps to highlight the contrasting income trends. Broadly defined per capita incomes in the United States have grown much faster than wages and salaries. This divergence is illustrated in Chart 1, which tracks alternative income measures deflated by the CPI[4] and normalized to 100 in

1973. The year 1973 is a suitable base because it represents both a cyclical peak and a longer period turning point for all income measures. Since 1973 both the BEA's real per capita personal income and the CPS's per capita money income have grown briskly, although at rates somewhat lower than those before 1973. By contrast, wages and salaries per worker have stagnated since 1973, actually falling from 1973 to 1979 before recovering between 1979 and 1989. What little growth occurred in compensation came in the form of nonwage supplements such as fringe benefits. Growth in nonpecuniary compensation was enough to keep total compensation from falling between 1973 and 1979 and to make it grow a total of about 4 percent from 1979 to 1989.

The divergence between the growth of real per capita personal income and the growth in worker income can be broken down into two factors: growth of the labor force participation rate and the change in compensation's share of personal income. Table 1 shows the decomposition as a simple growth-accounting identity. Most of the growth of per capita personal income in the United States over the last twenty-five years has been due to the rapid expansion of jobs relative to the population. This has been especially true for the period from 1973 to 1979, when annual employment growth exceeded population growth by 1.5 percentage points.[5] During the period following 1979 this differential narrowed to 0.7 percentage point. Nevertheless, the total differential between the growth rates of personal income per capita and of compensation per worker was maintained because the compensation share of income

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[3] Employer payments for fringe benefits are included in the compensation component of the NIPA, but they do not appear in the Census Bureau's CPS reports on individuals or households. Nevertheless, these forms of labor income are becoming increasingly important.

[4] To be consistent with the revision of the CPI in 1983, the retrospectively revised CPI-U-X1 is used to deflate income values before 1983. For a broader discussion of these issues, see Eugene Kroch, "Tracking Inflation in the Service Sector," in this issue of the *Quarterly Review*. Some have argued that the Personal Consumption Expenditure deflator is a better measure because it does not tend to overstate inflation as much as a fixed-weight index such as the

Footnote 4 continued
CPI. However, current-weight deflators include quantity effects as well as price effects and can understate inflation.

[5] Almost two-thirds of this employment growth was accounted for by women, whose working ranks grew by almost 62 percent, while male workers increased by about 23 percent. Since 1973 the overall labor force participation rate rose from 61 percent to 67 percent; it increased from about 45 percent to 58 percent for women, while for men it fell from 79 percent to 76 percent.

Chart 1

Real Average Income Trends

Index 1973 = 100

Table 1

Annual Average Growth Rates

	1967-73	1973-79	1979-89
Per capita annual income	4.3	1.7	1.6
plus compensation share of income	−0.8	0.0	−0.5
minus worker-to-population ratio	1.2	1.5	0.7
equals compensation per worker	2.3	0.1	0.4
Memo: per worker wages and salaries	1.8	−0.5	0.3

declined, largely as a consequence of falling real hourly wage rates and the strong growth in income from non-labor sources.

Wage trends

One important factor driving the decline in the compensation share of income and the slow growth in wages and salaries was the poor performance of hourly earnings for nonsupervisory and production workers in the private sector. Although by 1989 total work-force wages and salaries (including those for managers and supervisors) had returned to their 1973 levels (Chart 1), the average wages of nonsupervisory workers in the private sector actually declined during that interval nearly one-half of 1 percent per year after having grown about 2 percent per year during the period before 1973 (Chart 2). Table 2 shows that virtually all of the post-1973

decline occurred after 1979. The decline was less abrupt for year-round full-time workers,[6] especially after 1979, indicating that the fringes of the labor force experienced the largest real wage declines.

The fall in hourly wage rates was exacerbated by a downward trend in hours per week or per year. Chart 2

[6]Female year-round full-time earnings have actually risen, even though the decline in male earnings more than offsets this trend. The male decline dominates, not only because the male decline is steeper than the female rise, but also because there are 50 percent more male than female workers and men still earn 50 percent more than women.

Chart 2
Real Earnings Trends

Chart 3
Money Income Trends

Table 2
Annual Average Growth Rates

	1967-73	1973-79	1979-89
Average hourly earnings	2.0	0.0	−0.7
Average weekly earnings	1.6	−0.6	−1.0
Median year-round full-time earnings	1.9	−0.6	−0.1
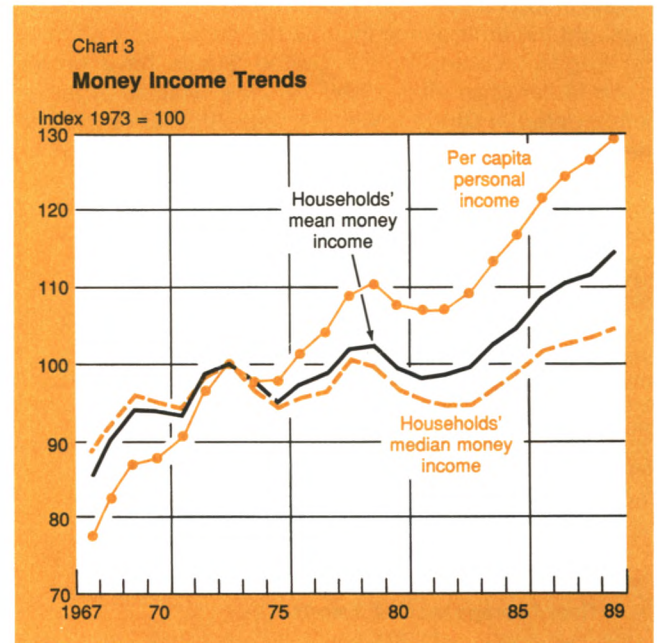
Table 3
Mean Family Money Income
(1989 dollars)

Quintile	1973	1979	1989	Percent Change 1973-89	Percent Change 1979-89
Lowest	6,061	5,994	5,886	−3.2	−2.1
Second	15,416	15,306	15,107	−2.0	−1.3
Middle	25,909	25,609	25,823	−0.3	0.8
Fourth	37,946	38,680	40,374	6.4	4.4
Highest	66,364	68,230	77,716	17.1	13.9
Average	30,341	30,764	32,978	8.7	7.2

Source: U.S. Congress, Committee on Ways and Means, *Overview of Entitlement Programs* (Washington, D.C.: Government Printing Office, 1991), p. 1184. These data are compiled from the Current Population Survey for March of 1974, 1980, and 1990.

shows that since 1973, a 6½ percent decline in mean hourly earnings has combined with a 6 percent decline in hours per week to lower weekly earnings by 12½ percent for all private nonagricultural, nonsupervisory workers. If the increase in leisure time—the flip side of the drop in hours worked—has value, clearly the weekly earnings decline overstates any decline in workers' true living standards. Hence, assessing living standards on the basis of weekly wage trends requires some judgment about how voluntary the decline in hours has been.[7] (While secular declines in hours *may* be a consequence of the increased value of leisure time, cyclical declines in hours certainly do reflect involuntary reductions.[8])

Household income trends

In many ways income trends are best understood from the standpoint of the basic economic unit, the family or household, rather than from that of the worker or the population at large. Annual household and family money income measures from the CPS have historically grown at about the same rate, especially since 1973. Although the family unit is technically a special type of household, the two are, of course, closely related in the data.[9] Income per household has not grown as fast as per capita income, because of the steady decline in household size and the steady increase in the proportion of the population living outside of the family unit. Chart 3 shows that since 1973 household money income has grown about half as fast as per capita money income, with more of this differential occurring between 1973 and 1979 than since 1979.

Income per household has grown faster than per worker wages and salaries, however, because the number of workers per household has increased and the share of household income from sources other than labor has grown. Since 1973 the number of workers per household has increased more than 10 percent. The increase occurred largely between 1973 and 1979, a period that accounts for most of the difference between

household income growth and worker income growth since 1973.

The median rather than the mean income best shows how the typical household has fared, because it represents the income of the "middle" household and hence is not significantly affected by large shifts in the incomes of either very rich or very poor households. Chart 3 reveals that median household incomes have grown even more slowly than mean household incomes, especially since 1979. This finding suggests that the household income distribution has become more skewed toward the upper brackets. Table 3 documents this change in the distribution of family income since 1973. The table gives annual average money incomes by quintile. It shows that the rise in real family incomes has been driven by the top two quintiles at the expense of the bottom 40 percent of families. Income inequality increased markedly during the period from 1979 to 1989: the top quintile incomes grew almost 14 percent while the bottom quintile incomes contracted more than 2 percent. These trends are consistent with the decline in the labor earnings share of income (Table 1) and with the greater decline in nonsupervisory wage earnings (Chart 2).[10]

Conclusion

Over the past two decades, the growth rates of per capita income and per worker wages have diverged substantially in the United States. Although real wages have stagnated, rapid employment growth has caused personal incomes to expand. The bulk of the difference between per capita income growth and per worker compensation growth can be traced to the rapid growth in labor force participation, especially from 1973 to 1979. During the period since 1979, however, an increasingly important factor underlying the divergence has been the decline in the real hourly wage rates of nonsupervisory or production workers. This decline in the wage rates of production workers, together with an increase in the share of personal income from nonlabor sources, has contributed to the increase in income inequality in the United States during the 1980s.

[7]See Gary Burtless, *A Future of Lousy Jobs?* (Washington, D.C.: Brookings Institution, 1990).

[8]Many economists have used hourly wage rates in this spirit to reflect the value of time and to impute income from nonmarket activities in order to broaden traditional measures of income. One of the most famous studies is by James Tobin and William Nordhaus, *Is Growth Obsolete?* National Bureau of Economic Research, 1972; for a more recent discussion, see Dale W. Jorgenson and Barbara Fraumeni, "Investment in Education and U.S. Economic Growth," in Charles Walker, Mark Bloomfield, and Margo Thorning, eds., *The U.S. Savings Challenge: Policy Options for Productivity and Growth* (Westview Press, 1990).

[9]Households can consist of a single individual or any number of individuals living together without regard to relationship. Families consist of two or more individuals related by kinship or marriage.

[10]They are also consistent with the finding that the dispersion in real wages and salaries has increased since the early 1970s. See Barry Bluestone and Bennett Harrison, "The Great American Jobs Machine: The Proliferation of Low Wage Employment in the U.S. Economy," a study prepared for the Joint Economic Committee of the U.S. Congress, 1986. This report led to a raft of publications largely corroborating its findings and searching for explanations, including Harrison and Bluestone's "Wage Polarization in the U.S. and the 'Flexibility' Debate," *Cambridge Journal of Economics*, vol.14, no.3 (September 1990), pp. 351-73. An excellent collection of related articles can be found in John D. Kasarda, ed., *Jobs, Earnings, and Employment Growth Policies in the United States* (Boston: Kluwer Academic Publications, 1990).

The Bank Credit "Crumble"

by Ronald Johnson

The role played by cutbacks in commercial loan supply in the U.S. economic downturn in 1990 remains a matter of considerable contention. Most observers acknowledge that the recession contributed to a contraction in the demand for business credit. They also recognize that the recession's adverse effect on corporate creditworthiness could alone explain some tightening of bank credit conditions last year.[1] Issues still unresolved, however, are whether and to what extent the 1990 cutbacks in commercial loans reflected not merely lower demand and consistent application of credit standards but also reductions of credit availability to borrowers of a given quality.[2]

A contraction in the supply of commercial loans can result from a traditional *credit crunch*, a nonprice rationing of credit for broad classes of borrowers; a *credit crumble*, a deflation in asset prices; or a broad-based *shortage of bank capital.* In 1990, the latter two forces were at work.

Factors that traditionally set the stage for credit crunches were absent in 1990. Heightened monetary restraint and a run-up in market interest rates, the

catalysts in previous crunches, did not materialize last year.[3] Moreover, banks did not experience disintermediation, because Regulation Q interest rate ceilings on saving accounts in banks and thrift institutions had been abolished in 1986.

By contrast, there is considerable evidence of the effects of a credit crumble in the U.S. commercial loan market in 1990. Credit crumbles when a decline in the value or quality of significant classes of bank loans or investments leads to a reduction in either the willingness or the capacity of banks to expand their lending.[4] As a result, firms of a given credit quality find their access to bank credit restricted. A 1990 credit crumble was in large part brought on by the drop in asset values and cash flows in commercial real estate, especially in the Northeast and Southwest, and by the collapse in leveraged buyouts.

Banks operating at low capital levels and those holding sizable amounts of troubled assets may have faced a shortage of capital to support asset growth, including commercial loans, in 1990. As a result, banks with weak capital may have reduced credit to borrowers of a given creditworthiness. Note that a low ratio of capital to

[1] The Federal Reserve's periodic Senior Loan Officers Opinion Survey indicates that banks tightened lending conditions through 1990 and continued into 1991. Some argue that this tightening was long overdue because the credit quality of U.S. corporations had, as Henry Kaufman notes, "deteriorated throughout the just-ended business expansion" in an unprecedented fashion. See Henry Kaufman, "The Great Debt Overload Will Keep the Recovery Feeble," *Fortune*, December 31, 1990, p. 23.

[2] See, for example, *Whether A "Credit Crunch" Exists in the New England or National Economy*, Hearing before the Subcommittee on General Oversight and Investigations of the House Committee on Banking, Finance and Urban Affairs, 101st Cong., 2d sess. (Washington D.C.: GPO, 1990).

[3] For a stimulating and insightful discussion of credit crunches in the post-World War II era, see Albert Wojnilower, "The Central Role of Credit Crunches in Recent Financial History," *Brookings Papers on Economic Activity*, 1980: 2, pp. 277-326.

[4] The concept of a credit crumble orignates with Irving Fisher's debt-deflation mechanism. See Irving Fisher, "The Debt Deflation Theory of Great Depressions," *Econometrica*, 1 (October 1933), pp.337-57. See also Ben Bernanke, "Nonmonetary Effects of the Financial Crisis in Propagation of the Great Depression," *American Economic Review*, March 1983, pp. 257-76.

assets can be the result of a previous policy of deliberate leveraging, unexpected problems with asset quality, or both. A downturn in the economy may expose the risks of low capitalization, which can show up in the risk premium attached to uninsured bank liabilities.
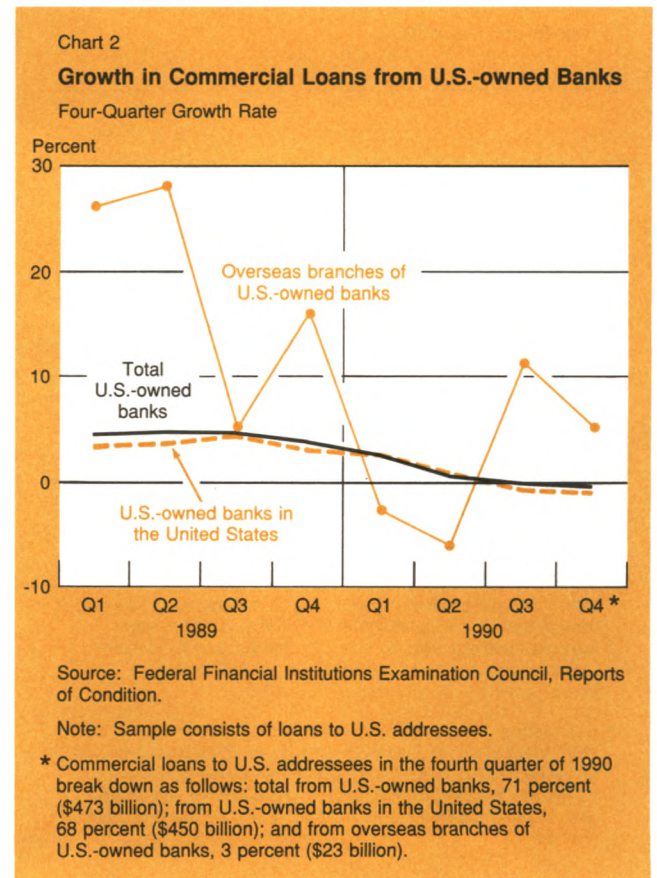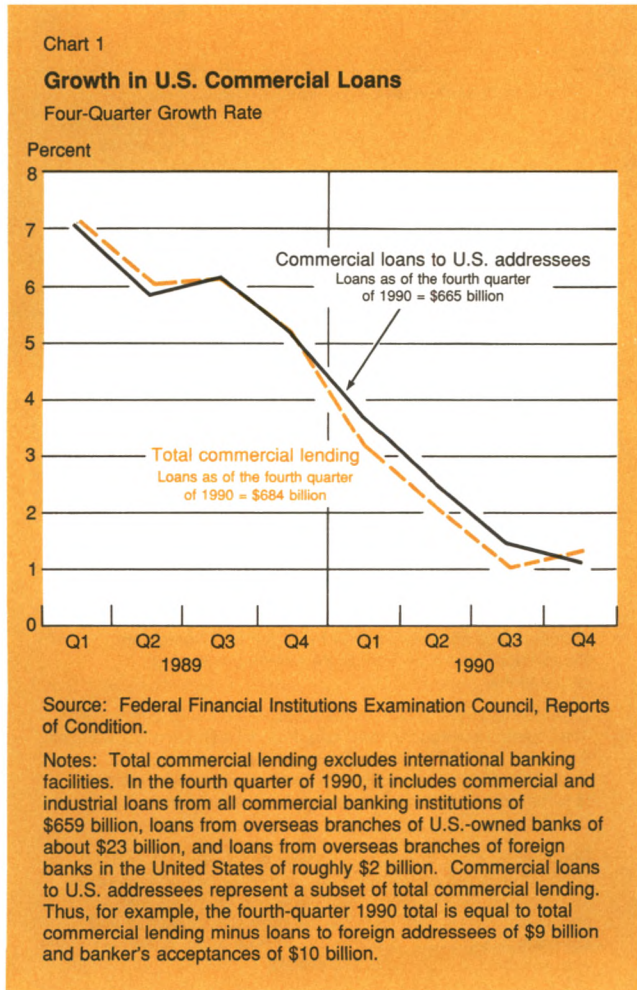
Any credit crumble and bank capital shortage in 1990 could only have been made worse by depressed bank share prices that rendered equity issuance virtually impossible. Thus, banks with troubled assets or inadequate capital may have been compelled to downsize their balance sheets—including retrenching their business lending—in order to stabilize their financial condition.

This article investigates the importance of the credit crumble and bank capital shortfalls in the contraction in commercial loan supply in 1990. Particular attention is given to the link between the strength of bank balance sheets and the recent slowdown in commercial and industrial loans to companies in the United States booked by banks in the United States.[5] The analysis reveals that the uneven pattern across banks in the slowdown in commercial lending growth can be only partly explained by the relative strengths and weaknesses in regional economic activity. A fuller explanation of the variation in rates of credit extension to businesses takes account of the financial strength of individual banks within regions.

The article shows that banks with weak balance sheets accounted for all of the cutback in commercial lending from U.S.-owned banks in 1990. In the aggregate, only those U.S.-owned banks with weak balance sheets reduced their business lending, while those with strong balance sheets continued to lend. This pattern held true across geographic regions of weak and strong economic activity and across categories of bank size.

[5]These loans include commercial loans to U.S. addressees from U.S.-owned banks in the United States and their overseas branches and from foreign bank subsidiaries, foreign branches and agencies, Edge Act and Agreement Corporations, and New York State foreign investment corporations.

Chart 1

Growth in U.S. Commercial Loans

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Total commercial lending excludes international banking facilities. In the fourth quarter of 1990, it includes commercial and industrial loans from all commercial banking institutions of $659 billion, loans from overseas branches of U.S.-owned banks of about $23 billion, and loans from overseas branches of foreign banks in the United States of roughly $2 billion. Commercial loans to U.S. addressees represent a subset of total commercial lending. Thus, for example, the fourth-quarter 1990 total is equal to total commercial lending minus loans to foreign addressees of $9 billion and banker's acceptances of $10 billion.

Chart 2

Growth in Commercial Loans from U.S.-owned Banks

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Note: Sample consists of loans to U.S. addressees.

* Commercial loans to U.S. addressees in the fourth quarter of 1990 break down as follows: total from U.S.-owned banks, 71 percent ($473 billion); from U.S.-owned banks in the United States, 68 percent ($450 billion); and from overseas branches of U.S.-owned banks, 3 percent ($23 billion).

Commercial loan growth in 1990

The recent weakness in the economy has undoubtedly had a depressing effect on the demand for business credit and on corporate credit quality. If the decline in commercial loan growth were attributable entirely to falling loan demand and consistent application of credit standards at the onset of the recession, then particularly weak loan growth at a bank should largely reflect a particularly weak regional economy. But if the decline also stems from cutbacks in the supply of loans to businessess, then weak loan growth at a bank would also be closely related to the strength of bank balance sheets.
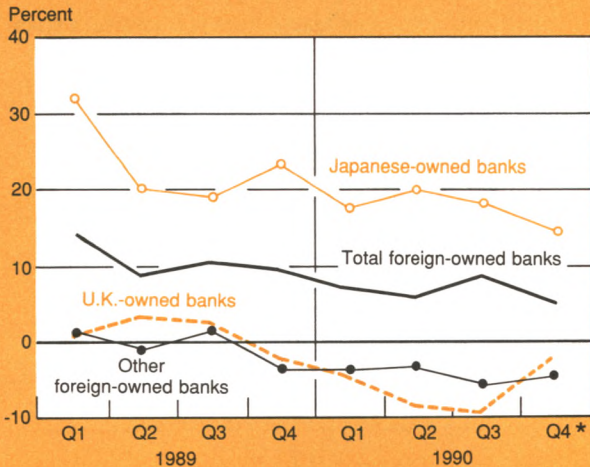
All commercial loans

The growth in total commercial and industrial (C&I) loans from commercial banks to firms in the United States slowed from 5.2 percent in 1989, on a fourth

Chart 3

Growth in Commercial Loans from Foreign-owned Banks

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Note: Sample consists of loans to U.S. addressees and includes foreign bank subsidiaries in the United States and foreign branches and agencies as well as Edge Act and Agreement Corporations and New York State foreign investment corporations.

* Commercial loans to U.S. addressees in the fourth quarter of 1990 break down as follows: total from foreign-owned banks, 29 percent ($191 billion); from Japanese-owned banks, 17 percent ($111 billion); from U.K.-owned banks, 2 percent ($13 billion); and from other foreign-owned banks, 10 percent ($67 billion).

Chart 4

Growth in Commercial Loans from Foreign Banking Institutions in the United States

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: The data on Japanese and U.K. bank subsidiaries in the United States are adjusted for the Japanese takeover of U.K.-owned Union Bank in the fourth quarter of 1988. Foreign branches and agencies include Edge Act and Agreement Corporations and New York State foreign investment corporations.

* Commercial loans to U.S. addressees in the fourth quarter of 1990 break down as follows: total from foreign bank subsidiaries, 9 percent ($60 billion); from Japanese bank subsidiaries, 3 percent ($19 billion); from U.K. bank subsidiaries, 1 percent ($10 billion); and from other foreign bank subsidiaries, 5 percent ($32 billion).

† Commercial loans to U.S. addressees in the fourth quarter of 1990 break down as follows: total from branches and agencies, 19.6 percent ($131 billion); from Japanese branches and agencies, 13.8 percent ($92 billion); from U.K. branches and agencies, 0.5 percent ($3 billion); and from other foreign branches and agencies, 5.3 percent ($35 billion).

quarter-to-fourth quarter basis, to 1.2 percent in 1990 (Chart 1).[6] It is quite interesting, however, that U.S.-owned banks as a group have been withdrawing from business lending, while foreign-owned banks in the United States as a group have continued to lend.

Commercial loans at U.S.-owned banks

Total outstanding commercial loans from U.S.-owned banks in the United States and their overseas branches (71 percent of C&I loans to U.S. firms) declined slightly in

[6]C&I loans from commercial banks to firms in the United States totaled $665 billion in the fourth quarter of 1990. This figure was obtained by summing 1) $659 billion of C&I loans booked at U.S. commercial banking institutions (although the Federal Reserve Statistical Release H.8 (510) Series estimates this aggregate at $651 billion based on the weekly reporting banks), 2) $23 billion of loans from overseas branches of U.S.-owned banks, and 3) about $2 billion of loans from overseas branches of U.S.-chartered foreign banks in the United States; and then subtracting $9 billion of loans to foreign addressees and $10 billion of banker's acceptances.

1990 after rising almost 4 percent in 1989, on a fourth quarter-to-fourth quarter basis (Chart 2). U.S.-owned banks excluding overseas branches (68 percent of C&I loans to U.S. firms) reduced their outstanding loans almost 1 percent in 1990 on a fourth-quarter to fourth-quarter basis, while continued, though uneven, growth in lending from overseas branches of U.S. banks offset the decline in stateside lending only slightly.

Commercial loans at foreign-owned banks

As U.S.-owned banks retrenched their business lending, foreign-owned banks (29 percent of C&I loans to U.S. firms) as a group continued to lend, albeit at a somewhat slower pace. As Chart 3 indicates, commercial loans from foreign-owned banks rose about 6 percent in 1990, down from the almost 10 percent growth

Chart 5

Growth in Commercial Loans from U.S.-owned Banks by Bank Size

Four-Quarter Growth Rate

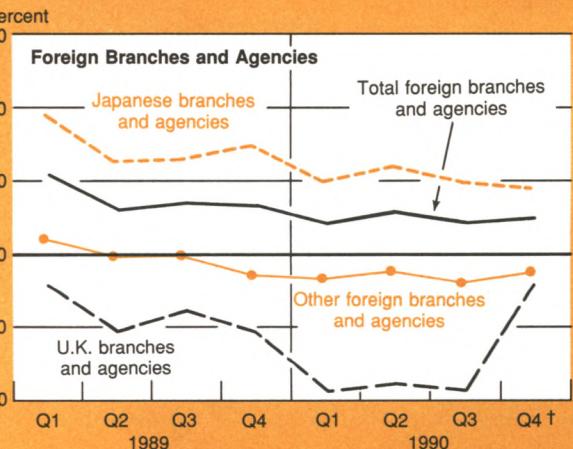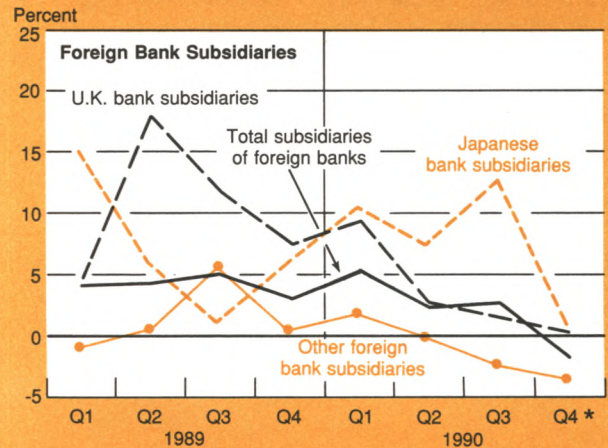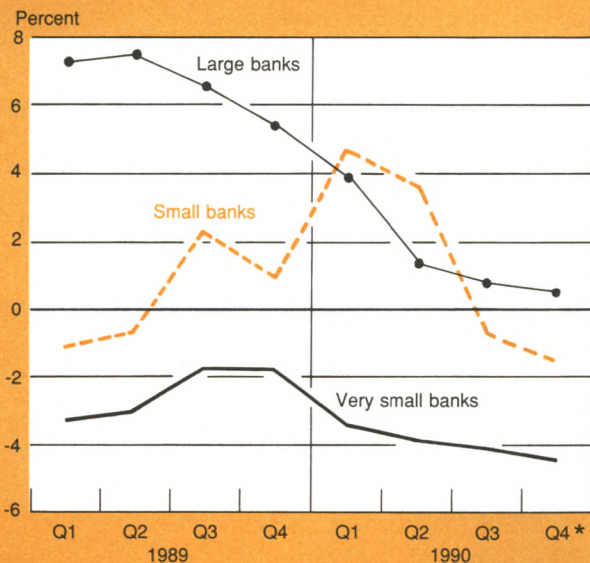Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees. Large banks have assets of $1 billion or more, small banks have assets between $300 million and $1 billion, and very small banks have assets of less than $300 million.

* Commercial loans to U.S. addressees in the fourth quarter of 1990 break down as follows: from large banks, 54 percent ($356 billion); from small banks, 6 percent ($41 billion); and from very small banks, 11 percent ($76 billion).

Table 1

Growth in Commercial Lending and Employment by Federal Reserve District in 1990-IV

Employment Growth (Estimated 1990 Percent in Parentheses)	Commercial Lending Growth (Percent)	
	Decline	Rise
Weak employment districts		
Boston (−3.3)	−14.9	
New York (−1.4)	−1.3	
Philadelphia (−0.0)	−4.5	
Moderate employment districts		
Chicago (0.4)		3.1
Richmond (0.4)		3.4
Atlanta (0.9)		1.9
St. Louis (1.2)		2.7
Dallas (1.3)	−8.0	
Strong employment districts		
Cleveland (1.6)	−2.2	
Minneapolis (1.6)	−3.0	
San Francisco (1.7)		5.1
Kansas City (2.0)		0.0

Sources: Bureau of Labor Statistics; Federal Financial Institutions Examination Council, Reports of Condition.

Notes: The commercial lending sample consists of loans to U.S. addressees from U.S.-owned banks. Districts are ranked by employment growth from the weakest to the strongest. District employment growth is the weighted average of state employment growth rates. For states that are split by district lines, statewide employment growth contributes to the average of two districts, with weights reflecting the population distributions. In 1990, on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, moderate employment districts posted between 0 and 1.5 percent growth, and strong employment districts posted growth in excess of 1.5 percent.

rate posted in 1989. In particular, Japanese-owned banks (17 percent of C&I loans to U.S. firms) increased their business loans by more than 14.5 percent in 1990. U.K.-owned banks and other foreign-owned banks, however, have been reducing their lending to U.S. businesses since 1989.

Within the category of foreign-owned banks in the United States, however, there are some clear distinctions in lending growth between foreign-owned bank subsidiaries and the branches and agencies of foreign banks (Chart 4). Most strikingly, subsidiaries of foreign banks as a group have sharply reduced their commercial lending growth, while branches and agencies of foreign banks as a group have slowed loan growth only slightly. This fact is not surprising, however, given that the balance sheets of foreign bank subsidiaries, especially with regard to the proportion of real estate loans, resemble the balance sheets of U.S.-owned banks.

The pattern of commercial lending growth from branches and agencies of foreign banks was also quite uneven in 1990. Japanese branches and agencies slowed commercial loan growth only slightly, recording a still high 19 percent growth rate for 1990. Branches and agencies of the United Kingdom and other foreign countries, however, had been reducing their U.S business loan exposures at least since early 1989.

Summary
Commercial loans to firms in the United States showed an across-the-board slowdown in 1990. On its face, this finding appears consistent with the view that in 1990 *only* recession-induced effects on business credit

demand and on corporate credit quality mattered. If this view is correct, however, it is hard to understand why U.S.-owned banks, in aggregate, cut back their business lending in the United States last year, while foreign-owned banks—particularly Japanese branches and agencies—increased their lending and thus their share of the U.S. commercial loan market.

Commercial loan retrenchment and regional economic activity

This section provides some perspective on the relationship between commercial loan retrenchment by U.S.-owned banks and regional economic activity. This relationship can be observed when banks are grouped by size and by Federal Reserve district. Although the measures used are not precise, they indicate that business loan retrenchment by U.S.-owned banks was not solely concentrated in weak economic regions.

Growth in commercial loans extended by U.S.-owned banks decelerated throughout 1990, regardless of the size of the bank (Chart 5). Small-scale banks (encompassing "small banks" and "very small banks"), with less than $1 billion in assets, reduced their outstanding commercial loans last year. Large banks, with more than $1 billion in assets, recorded only a very modest increase in their business lending in 1990.

Growth in commercial lending by small-scale banks may have a particularly close relationship with economic activity in a given region. One reason is that loans by small-scale banks are more geographically concentrated. Moreover, large banks often tie up a portion of their business-lending capacity in the form of

Table 2

Real Estate Loan Quality Ratios by Bank Size and by Regional Employment Growth

	Real Estate Loan Quality Ratio (Real Estate Ratio in Percent; Commercial Loans as of 1990-IV in Parentheses)		
Bank Classification	High-Quality Portfolio	Low-Quality Portfolio	Total
Weak employment districts			
Small banks	9 ($2.5 billion)	90 ($2.9 billion)	53 ($5.4 billion)
Large banks	11 ($18.7 billion)	86 ($111.0 billion)	75 ($129.7 billion)
Moderate and strong employment districts			
Small banks	10 ($17.3 billion)	57 ($4.4 billion)	20 ($21.7 billion)
Large banks	13 ($109.4 billion)	56 ($93.6 billion)	33 ($203.0 billion)

Sources: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of U.S.-owned banks. In 1990, on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, and moderate and strong employment districts posted zero-to-positive growth. Small banks have assets between $300 million and $1 billion, and large banks have assets of $1 billion or more. Low-quality portfolios have a ratio of nonaccrual plus delinquent real estate loans to tier 1 capital that exceeds 25 percent.

loan commitments in support of commercial paper. In contrast, business lending by small-scale banks may be targeted more directly at the working capital needs of local businesses and thus may show a greater sensitivity to the fortunes of the local or regional economy.

Evidence of the relationship between the current eco-nomic slowdown and the decline in commercial lending by Federal Reserve district can be pieced together by examining employment growth in different parts of the country. Using employment growth as a measure of regional economic activity, one finds that the shrinkage in commercial loans outstanding in 1990 was not concentrated solely in the regions that posted the weakest economic activity (Table 1). To be sure, all three of the

Chart 6

Growth in Commercial Loans from Small U.S.-owned Banks by Real Estate Loan Quality
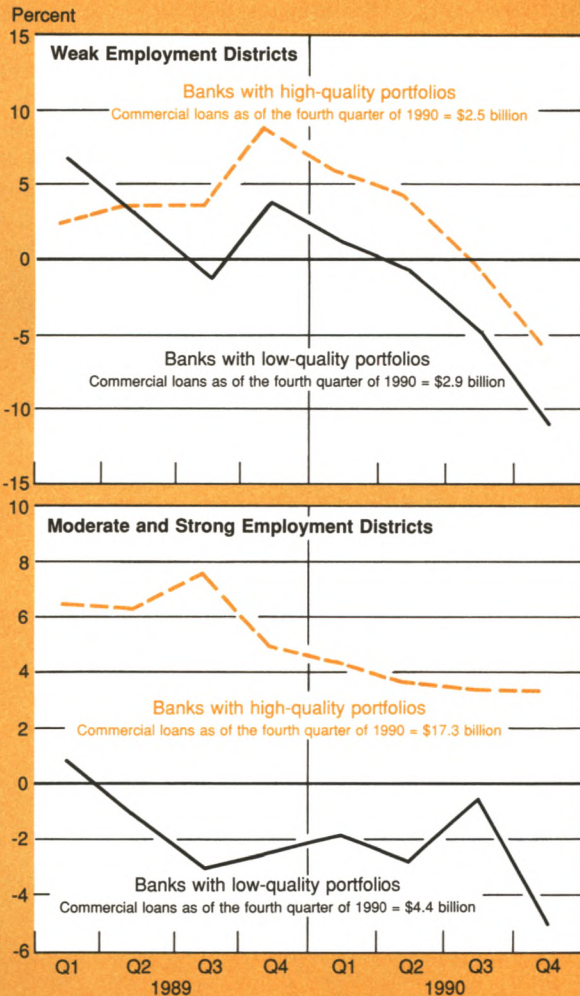
Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees from banks with assets between $300 million and $1 billion. Low-quality portfolios have a ratio of nonaccrual plus delinquent real estate loans to tier 1 capital that exceeds 25 percent.

Chart 7

Growth in Commercial Loans from Large U.S.-owned Banks by Real Estate Loan Quality
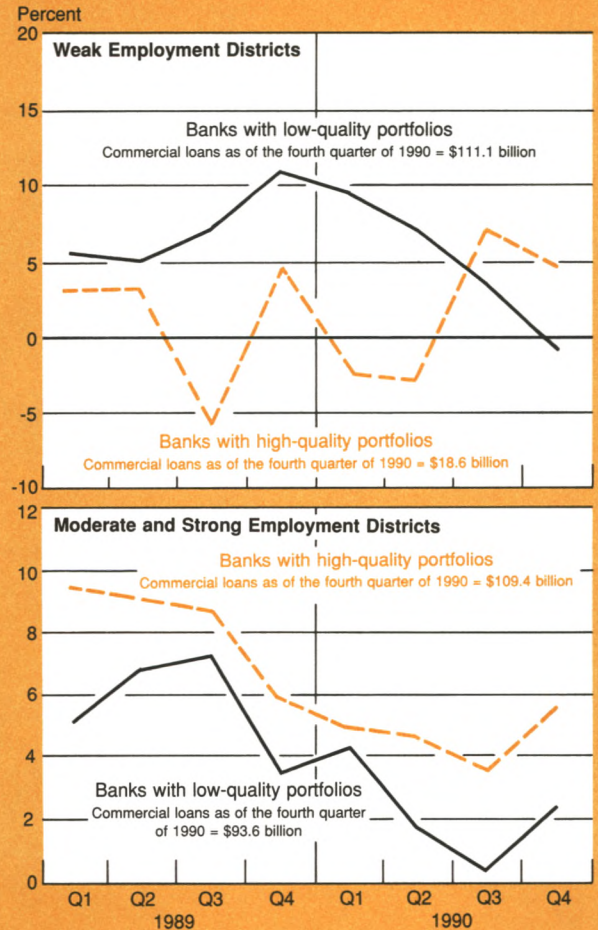
Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees from banks with assets of $1 billion or more. Low-quality portfolios have a ratio of nonaccrual plus delinquent real estate loans to tier 1 capital that exceeds 25 percent.

Federal Reserve districts showing job losses in 1990 (Boston, New York, and Philadelphia) also reported shrinkage in commercial loans outstanding in 1990 on a fourth quarter-to-fourth quarter basis. At the same time, however, three other districts posting job gains last year (Cleveland, Dallas, and Minneapolis) also recorded contractions in commercial loans outstanding.

Commercial lending growth and bank balance sheet characteristics

This section examines the link between the strength of bank balance sheets and commercial loan growth to measure the effect of a credit crumble and bank capital shortfalls on the ability of banks in 1990 to make commercial loans. The strength of a bank's balance sheet is measured in three ways: 1) the quality of the bank's real estate portfolio at end-1990, 2) the bank's capital ratio at end-1990, and 3) the stability of the bank's Standard and Poor's bond rating in 1990.[7]

To isolate the effect of supply cutbacks, it is necessary to control for the downward shift in the demand for business credit. Unfortunately, a straightforward way to control for demand shifts is only available for the first two measures of the strength of bank balance sheets (the quality of the bank's real estate portfolio and the bank's capital ratio). In both cases, banks are sorted by the condition of their regional economies and by their size. Banks in weak districts—districts with negative

[7]The commercial loan sample size for both the real estate loan quality ratio and the bank capital ratio is $27.1 billion for small banks and $332.7 billion for large banks in the fourth quarter of 1990. These samples represent 67 percent (94 percent) of all C&I loans to U.S. firms from small (large) U.S.-owned bank in the fourth quarter of 1990. In the case of Standard and Poor's bond ratings, the sample consists of fifty-one bank holding companies with commercial loans of $313 billion in the fourth quarter of 1990, representing 47 percent of C&I loans to U.S. firms.

Table 3

Change in Commercial Lending Growth from 1989 to 1990 and Real Estate Loan Quality

	Change in Commercial Loan Growth (Percentage Points)	
Bank Classification	High-Quality Portfolios	Low-Quality Portfolios
Weak employment districts		
Small banks	−14.7	−14.7
Large banks	−0.1	−11.8
Moderate and strong employment districts		
Small banks	−1.6	−2.5
Large banks	−0.4	−1.1

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Table shows change in the four-quarter growth rate of commercial lending from the fourth quarter of 1989 to the fourth quarter of 1990. Sample consists of U.S.-owned banks. In 1990, on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, and moderate and strong employment districts posted zero-to-positive growth. Small banks have assets between $300 million and $1 billion. Large banks have assets of $1 billion or more. Low-quality portfolios have a ratio of nonaccrual plus delinquent real estate loans to tier 1 capital that exceeds 25 percent.

Table 4

Bank Capital Ratios by Bank Size and by Regional Employment Growth

	Bank Capital Ratio (Capital Ratio in Percent; Commercial Loans as of 1990-IV in Parentheses)		
Bank Classification	Well-Capitalized Banks	Low-Capital Banks	Total
Weak employment districts			
Small banks	12 ($4.5 billion)	7 ($0.9 billion)	11 ($5.4 billion)
Large banks	10 ($71.6 billion)	7 ($58.1 billion)	9 ($129.7 billion)
Moderate and strong employment districts			
Small banks	15 ($20.9 billion)	7 ($0.8 billion)	15 ($21.7 billion)
Large banks	10 ($149.5 billion)	7 ($53.5 billion)	9 ($203.0 billion)

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of U.S.-owned banks. In 1990, on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, and moderate and strong employment districts posted zero-to-positive growth. Small banks have assets between $300 million and $1 billion, and large banks have assets of $1 billion or more. Capital is measured on a risk-weighted basis. Low-capital banks have less than the 8 percent capital that is required as of December 31, 1992.
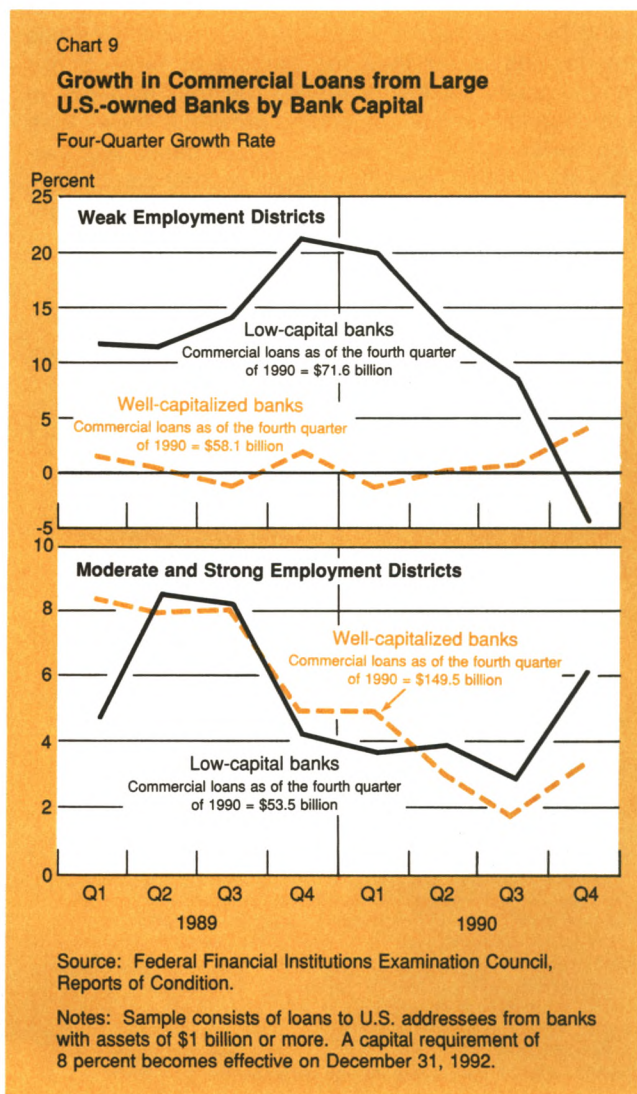
employment growth on a 1990 fourth quarter-to-fourth quarter basis—form one group; banks in moderate-to-strong districts—districts with zero to positive employment growth—form another. The analysis is performed in terms of the growth in commercial loans and the *change* in commercial lending growth from 1989 to 1990 to check for the robustness of the findings. A more formal test of the robustness of the findings that employs the analysis of variance procedure is also presented in the appendix.

Banks' real estate loan quality and lending to business
The real estate loan quality ratio is introduced to cap-

ture, at least in part, the effect of the credit crumble on the commercial lending capacity of banks. This ratio is obtained by dividing nonaccruing real estate loans (those for which interest is recorded only as received) plus delinquent real estate loans by tier 1 capital.[8] The sample is then sorted into banks with real estate loan quality ratios above 25 percent and banks with ratios below 25 percent. Note that within the category of banks with troubled real estate portfolios, problem property loans bulk much larger in relation to capital at

[8]Tier 1 capital for bank holding companies includes common equity, minority interests in equity accounts of consolidated subsidiaries, and qualifying perpetual preferred stock. Perpetual preferred stock is limited to 25 percent of tier 1 capital.

Chart 8

Growth in Commercial Loans from Small U.S.-owned Banks by Bank Capital

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees from banks with assets between $300 million and $1 billion. A capital requirement of 8 percent becomes effective on December 31, 1992.

Chart 9

Growth in Commercial Loans from Large U.S.-owned Banks by Bank Capital

Four-Quarter Growth Rate

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees from banks with assets of $1 billion or more. A capital requirement of 8 percent becomes effective on December 31, 1992.

those banks located in districts with weak employment growth than at the banks in districts with stronger growth (Table 2). Further, note that the dollar share of large bank commercial loans extended by large banks with serious real estate loan problems far exceeds the share of small bank commercial loans extended by small banks with serious real estate loan problems.

The effect of a credit crumble on the U.S. commercial loan market in 1990 is quite clear. Chart 6, which groups small banks by the quality of their real estate portfolios, shows that in both weak and moderate-to-strong districts, commercial lending by small banks with high-quality real estate portfolios has been growing faster than the lending by small banks with low-quality portfolios. Similarly, Chart 7, which groups large banks by the quality of their real estate portfolios, demonstrates that in moderate-to-strong districts, commercial lending by large banks with high-quality portfolios has been growing faster than the lending by large banks with low-quality portfolios. Table 3 provides evidence of the change in commercial lending growth: it shows that, except for small banks in weak districts, banks with low-quality portfolios slowed the growth of their commercial loans to a greater extent than did banks with high-quality portfolios.

Banks' capitalization and lending to business

Bank capital is measured as the ratio of shareholders' equity and certain long-term debt to risk-adjusted assets. Note that well-capitalized small banks have higher capital ratios than large banks regardless of the condition of their regional economies and that low-capital banks account for a much smaller proportion of small bank commercial loans (Table 4).

In general, bank capital shortfalls appear to have constrained commercial lending growth in 1990. In weak employment districts, small banks with low capital have cut back their lending by much more than banks with capital levels exceeding 8 percent (Chart 8). In moderate-to-strong employment districts, low-capital small banks have reduced their loans, while well-capitalized small banks have continued to increase lending.

Before 1990, large banks with low capital had been increasing their commercial loans faster than large banks with high capital in the weak employment districts but, starting in 1990, they began to slow their loan

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Table 5

Change in Commercial Lending Growth from 1989 to 1990 and Bank Capital

Bank Classification	Change in Commercial Loan Growth (Percentage Points)	
	Well-Capitalized Banks	Low-Capital Banks
Weak employment districts		
Small banks	−10.5	−31.8
Large banks	2.3	−25.9
Moderate and strong employment districts		
Small banks	−1.4	−8.3
Large banks	−1.6	1.9

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Chart shows change in the four-quarter growth rate of commercial lending from the fourth quarter of 1989 to the fourth quarter of 1990. Sample consists of U.S.-owned banks. In 1990 on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, and moderate and strong employment districts posted zero-to-positive growth. Small banks have assets between $300 million and $1 billion. Large banks have assets of $1 billion or more. Capital is measured on a risk-weighted basis. Low-capital banks have less than the 8 percent capital that is required as of December 31, 1992.
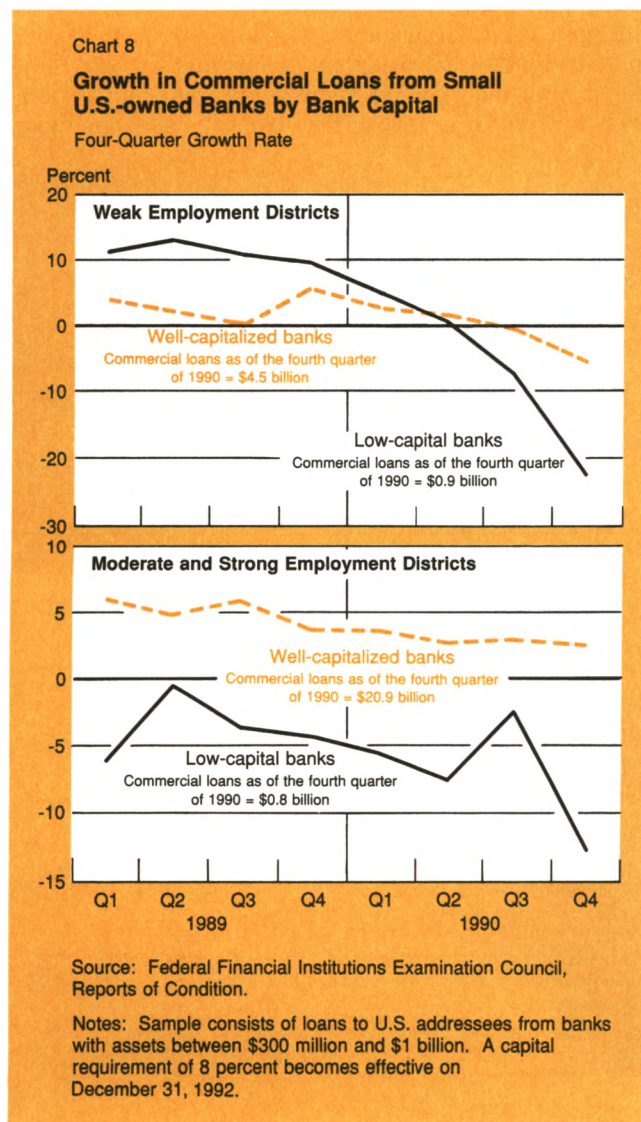

Chart 10

Growth in Commercial Loans from Bank Holding Companies by Stability of Standard and Poor's Bond Rating

Four-Quarter Growth Rate

Downgraded during 1990
Commercial loans as of the fourth quarter of 1990 = $222.5 billion

Stable or upgraded during 1990
Commercial loans as of the fourth quarter of 1990 = $90.0 billion
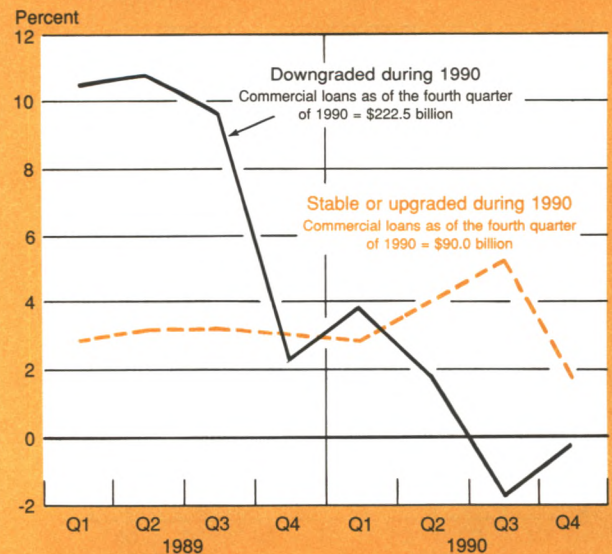
Sources: Federal Financial Institutions Examination Council, Reports of Condition; Standard and Poor's Corporation, Bank Compustat.

Notes: Sample includes fifty-one bank holding companies assigned Standard and Poor's bond ratings for 1990. Thirty-six bank holding companies had downgraded ratings and fifteen had stable or upgraded ratings.

growth sharply, and by the fourth quarter of 1990 they were actually shrinking their business loans (Chart 9). As in the case of large banks grouped by the quality of their real estate portfolios, the lending behavior of low-capital and well-capitalized banks in the moderate-to-strong employment districts is similar. For the weak and moderate-to-strong districts taken together, there was virtually no growth in commercial lending by large banks with low capital, while loans from well-capitalized large banks increased by more than 3 percent. Moreover, with the exception of large banks in moderate-to-strong employment districts, banks with low capital slowed their commercial loan growth more than banks with high capital (Table 5).

Bank debt ratings and lending to business
Pressure on banks from the money and capital markets is measured by whether a bank's debt was downgraded by Standard and Poor's in 1990. Grouping bank holding companies by the stability of their Standard and Poor's ratings in 1990 confirms the previous finding that the quality of bank portfolios is linked to the decline in business credit. Chart 10 shows that downgraded banks for the most part have been reducing their business loans. The weight of the evidence is particularly strong for banks that ended 1990 rated AA (Table 6). In addition, note that banks rated A or above with stable or upgraded ratings have continued to show positive commercial loan growth.

Summary and conclusions
In 1990, the pattern of the slowdown in U.S. commercial

lending growth across banks was quite uneven. Nevertheless, despite the inconsistency in commercial loan extensions last year, certain clear-cut trends emerged. For example, in aggregate, U.S.-owned banks reduced their business loans, while foreign-owned banks continued to extend business credit at a relatively fast pace.

Even among U.S.-owned banks, only *certain* groups of banks have cut back on their business loans. When U.S.-owned banks are grouped by size, only banks with assets under $1 billion posted reductions in business credit. When U.S.-owned banks are grouped by Federal Reserve district, only six districts (Boston, Dallas, Philadelphia, Minneapolis, Cleveland, and New York), accounting for 32 percent of C&I loans to U.S. firms, posted declines in their 1990 commercial lending.

The article's main conclusion is that both a cutback in the supply of loans and the effects of the current economic slump contributed importantly to the uneven pattern across U.S.-owned banks in the extension of commercial loans in 1990. As is typical during recessions, the demand for business credit waned and the

Table 6

Growth in Commercial Lending from Bank Holding Companies in 1990 by Stability of Standard and Poor's Bond Rating

Bond Rating	Growth in Commercial Loans in 1990 (Percent)	
	Downgraded in 1990	Stable or Upgraded in 1990
AAA		5.2
AA	−7.0	3.4
A	6.5	4.0
BBB	−5.3	−4.8
Non-investment grade	−9.7	
Total	−0.3	2.0

Sources: Standard and Poor's, Bank Compustat; Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of loans to U.S. addressees. Thirty-six bank holding companies had their ratings downgraded one or more steps in 1990. Fifteen bank holding companies had rating upgrades or stable ratings in 1990.

Table 7

Growth of Commercial Lending in 1990 by U.S.-owned Banks
(Percent)

Bank Characteristics	Weak Employment Districts	Moderate and Strong Employment Districts
Real estate loan quality ratio		
High-quality	3.4	5.2
Small banks	−5.9	3.3
Large banks	4.7	5.5
Low-quality	−1.1	2.0
Small banks	−11.1	−5.0
Large banks	−0.8	2.4
Bank capital ratio		
Well-capitalized	3.4	3.2
Small banks	−5.3	2.1
Large banks	4.2	3.3
Low-capital	−5.0	5.7
Small banks	−22.7	−12.8
Large banks	−4.7	6.1

Source: Federal Financial Institutions Examination Council, Reports of Condition.

Notes: Sample consists of U.S.-owned banks. In 1990, on a fourth quarter-to-fourth quarter basis, weak employment districts posted negative growth, and moderate and strong employment districts posted zero-to-positive growth. Small banks have assets between $300 million and $1 billion. Large banks have assets of $1 billion or more. Low-quality portfolios have a ratio of nonaccrual plus delinquent real estate loans to tier 1 capital that exceeds 25 percent. Capital is measured on a risk-weighted basis. Low-capital banks have less than the 8 percent capital that is required as of December 31, 1992.

riskiness of borrowers' projects and overall financial conditions increased. The effect of the recession on the U.S. commercial loan market last year is quite clear. For example, as Table 7 shows, the growth of commercial loans from banks in weak employment districts was generally much lower than the growth in commercial lending from banks in strong employment districts.

A falloff in the supply of business loans occurred last year as banks with weakened balance sheets restricted lending. The evidence is most striking for large banks in weak employment districts and small banks in moderate-to-strong employment districts. In both cases, banks with weak balance sheets reduced their outstanding commercial loans, while banks with strong balance sheets increased their outstanding loans.

In the case of small banks in weak employment districts and large banks in moderate-to-strong employment districts, commercial lending by those banks with weak balance sheets has more closely resembled the pattern of lending by banks with strong balance sheets. Nonetheless, with the exception of low-capital large banks in moderate-to-strong employment districts, banks with weak balance sheets posted lower growth in commercial loans on a fourth-quarter 1990 basis than did banks with strong balance sheets.

It appears that the contraction in commercial loan supply in 1990 was precipitated by both a credit crumble and bank capital shortfalls. The evidence suggests that the credit crumble, as measured by bank exposure to bad real estate, was the more important of the two factors last year. Banks with the lowest lending growth in 1990 on average had greater exposure to bad real estate loans on a fourth quarter-to-fourth quarter basis. The article also indicates that the effects of both the credit crumble and the bank capital shortages are most pronounced in weak economic conditions.

On balance, therefore, the evidence is consistent with the view that both recession-related factors and diminished lending capacity at certain banks were at work in the U.S. commercial loan market in 1990. Recession-related factors included a decline in the demand for loans because of weak economic conditions and a tightening of credit stemming from the application of customary standards of creditworthiness to borrowers whose financial condition had deteriorated from the recession. In addition, diminished bank lending capacity reduced the supply of credit from certain classes of banks to borrowers of a given credit quality.

Appendix: A Test of the Significance of Bank Balance Sheet Effects

The findings reported in the text on the contraction of commercial loan supply in 1990 were obtained by grouping banks by particular balance sheet characteristics and then examining each group's 1990 commercial lending growth. Although these findings offer evidence that the group of banks with weak balance sheets have on balance retrenched their commercial loans while the group of banks with strong balance sheets have on balance continued to lend, it is not evident that the identified differences in bank lending behavior are significant. To address this issue, a formal test of the statistical significance of the article's findings is made.

This section examines whether the differences observed in 1990 commercial lending growth between banks with contrasting balance sheet characteristics are indicative of actual differences. The procedure employed is generally known as the analysis of variance and involves a comparison of the weighted-average fourth-quarter 1990 growth of commercial lending from banks grouped by economic region, size, and the strength of their balance sheets. The procedure uses the F-statistic

as a summary measure to test whether the estimated group averages are distinct. The analysis determines whether the estimated test statistic, which is designed to compare the 1990 commercial lending behavior of banks whose balance sheets are weak with that of banks whose balance sheets are strong, is significant. A significant F-statistic indicates that there was a meaningful difference in the lending behavior of banks grouped by the strength of their balance sheets in 1990.

The estimated F-statistics and their associated confidence levels are shown in the table. For the most part, the identified differences in the lending behavior of banks grouped by their balance sheet characteristics are significant. Oddly enough, insignificant test statistics are found only in the case of comparisons of commercial lending growth by bank capital ratio. For both small banks in weak employment districts and large banks in moderate-to-strong employment districts, the estimated test statistics comparing commercial lending are insignificant.

Summary of Test Results Comparing Commercial Lending Growth for Banks with Different Balance Sheet Characteristics

Bank Classification	Real Estate Loan Quality Ratio		
	Degrees of Freedom (Numerator, Denominator)	F-Statistic	Confidence Level (Percent)
Weak employment districts			
Small banks	267, 83	1.9	99
Large banks	78, 144	2.2	99
Moderate and strong employment districts			
Small banks	34, 36	23.0	99
Large banks	53, 32	4.0	99
Bank Classification	Bank Capital Ratio		
	Degrees of Freedom (Numerator, Denominator)	F-Statistic	Confidence Level (Percent)
Weak employment districts			
Small banks	334, 15	1.8	83
Large banks	34, 188	2.8	99
Moderate and strong employment districts			
Small banks	61, 9	4.5	97
Large banks	67, 18	1.9	86

Sources: Federal Financial Institutions Examination Council, Reports of Condition.

A Disaggregate Analysis of Discount Window Borrowing

by Kausar Hamdani and Stavros Peristiani

At its inception, the Federal Reserve discount window was expected to be the principal instrument of central banking operations. Although open market operations have long since displaced the window in this role, discount window borrowing remains an important source of bank reserves. The window provides relief for short-term liquidity pressures that may develop for depository institutions when they are subject to unexpected outflows in their reserve positions. It is not surprising, therefore, that economists continue to study the behavior of discount window borrowing.[1]

The empirical work has focused on the "borrowing function"—the relationship between discount window borrowing and its key determinants—at the aggregate

level, with the estimation results typically interpreted as describing the "representative" bank's behavior.[2] A common finding of such studies is that borrowings are positively related to the spread of the federal funds rate over the discount rate. Since depository institutions can obtain reserves only from each other or the Federal Reserve, they come to the window to meet their reserve needs when the alternative cost of reserves—the federal funds rate—rises relative to the discount rate.[3] A second, less intuitive finding is that an individual bank's current level of borrowings is positively related to last period's, typically weekly, level—the phenomenon of positively autocorrelated borrowings. Because adjustment borrowing is usually the cheapest source of reserves for banks, the window is administered so as to make the ability to borrow a privilege for banks and not an automatic right. The usual practice of discount window administration creates an expectation that when a bank borrows, it diminishes its leeway with the Federal Reserve for further borrowings in the near term. In the aggregate, however, a relation contrary to this expectation holds.

The pattern of borrowing as seen in a scatter plot

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[1]There are four types of discount window credit: adjustment, seasonal, extended and emergency credit. Adjustment credit, the focus of this article, helps eligible depository institutions, on a short-term basis, meet a temporary need for funds or cushion briefly more persistent fund outflows while effecting orderly balance sheet adjustments. Adjustment credit is provided only when funds are not reasonably available in the money markets or from usual lenders, including institutional funding sources. Seasonal credit is available to institutions of relatively small size that can demonstrate a clear pattern of recurring intra-yearly swings in funding needs that cannot be satisfied from usual sources. Extended credit involves longer term funds to institutions experiencing special difficulties arising from exceptional circumstances or practices involving individual institutions or from liquidity strains affecting a broad range of depository institutions. Such funding is provided only after all other sources of funds, including special industry lenders, has been exhausted, and only where the lending is judged to be in the public interest. In unusual and exigent circumstances, the Board of Governors may authorize a Reserve Bank to provide emergency credit to individuals, partnerships, and corporations that are not depository institutions if credit is not otherwise available and failure to extend credit would adversely affect the economy. Emergency credit has not been used since the 1930s. See Board of Governors of the Federal Reserve System, *The Federal Reserve Discount Window*, 1990, for details.

[2]All depository institutions may borrow from the window; in this article, we use the terms "bank" and "depository institution" interchangeably.

[3]This relationship was proposed by Robert Turner, *Member Bank Borrowing* (Columbus, Ohio: Ohio State University Press, 1938), and formalized by Murray E. Polakoff, "Reluctance Elasticity, Least Cost, and Member Bank Borrowing: A Suggested Integration," *Journal of Finance*, vol. 16 (March 1960), pp. 1-18, and Stephen M. Goldfeld and Edward J. Kane, "The Determinants of Member Bank Borrowing: An Econometric Study," *Journal of Finance*, vol. 21 (September 1966), pp. 499-514.

(Chart 1) relating weekly borrowings to the interest rate spreads observed over those same weeks suggests that borrowing is less sensitive to the spread at high and low values of the spread. In other words, banks, in the aggregate, appear to be less responsive to the opportunity cost of reserves for the more extreme values of the spread. Furthermore, the scatter plot exhibits an unusual funnel configuration suggesting that borrowing becomes more variable at higher levels of spread.

Such anomalies have prompted some researchers to work on improving the aggregate-level specification. This article, however, seeks to shed light on the anomalies by specifying the borrowing function at the individual bank level. Accepting the influence of the federal funds–discount rate spread, we model the effects of discount window administration on individual bank demand for adjustment credit. This specification is estimated for 240 individual commercial banks that borrowed more than a minimum number of times from January 1981 to August 1990. We then simulate individual demand functions and show that the implied aggregate borrowings exhibit the same general pattern and data anomalies as actual aggregate borrowings.

The disaggregate approach is useful because it allows individual banks to have similarly specified individual demand functions but at the same time to exhibit idiosyncratic behavior. This approach confirms the finding of earlier studies that the demand for adjustment borrowing increases with the cost of alternative sources of reserves. It also yields the following conclusions:

- Depository institutions differ in their responses to discount window administration. Each institution lets its borrowing demand reach some minimum level before it exercises its privilege. Generally, this threshold level is proportionately lower for smaller banks than for larger banks. At low levels of the spread, most banks' demand for adjustment borrowing is below their threshold levels. Hence little or no borrowing will be observed in the aggregate for a range of low values; diagrammatically, the borrowings function will be flatter near the origin. Similarly, because banks may not be able to borrow as much as they would ideally like at very high levels of the spread, the borrowings function should be flatter in that region also. Both of these characteristics help explain the nonlinearity of the scatter plot. In other words, our analysis shows that banks' heterogeneous responses to how the discount window is administered are sufficient to explain the observed S-shaped nonlinearity in the aggregate borrowings function.
- The funnel shape of the data comes from another, though related, source. At high levels of the

spread, more and more banks are likely to come to the window. Moreover, each bank responds to given rate conditions in its own individual way. Hence high levels of aggregate borrowings are usually correlated with a greater number of disparate institutions visiting the window. This increased heterogeneity of banks at the window causes the aggregate borrowing function to be more variable at high levels of the spread.

- Positively autocorrelated borrowings are observed for individual small banks but not for individual large banks. This result most likely reflects the Federal Reserve's greater tolerance of consecutive-period borrowing by smaller banks. The Federal Reserve recognizes that small banks may have only limited access to national money markets and may need more time to correct unexpected liquidity pressures.
- Lastly, there is evidence that a majority of larger banks conserve on their use of the window if they expect the cost of reserves to rise in the next maintenance period.

Individual bank demand for adjustment borrowing

Individual banks facing a reserve need must decide whether to visit the discount window or to borrow reserves from other depository institutions. All else equal, if the discount rate is below the federal funds rate, banks would prefer to come to the Federal Reserve because adjustment credit would then be the cheapest source of funds. In practice, however, unlimited access is not possible because the window is administered as a privilege and not as an automatic right. Borrowers are expected to seek other reasonably available sources of funds before turning to the window for assistance and to have an appropriate reason for the request. Credit is granted at the discretion of the Reserve Bank and is always secured.

In effect, this practice introduces an implicit cost to discount window use not reflected in the federal funds–discount rate spread. Consequently, the amount that a bank actually borrows, denoted by B_{it}^d, may not always reflect the bank's unconstrained or notional demand for discount window credit, denoted by B_{it}^{*d}.

Actual and notional borrowings differ under two sets of circumstances. The nonprice mechanism may lead a bank to wait until its borrowing need exceeds some minimum or threshold level before the bank will actually use its window privilege. Such a reservation level is likely to reflect the implicit cost of borrowing and may depend on, among other considerations, the borrower's recent discount window usage—in particular, the size of the borrowings, the frequency of visits, and the number of consecutive visits. Moreover, even

Chart 1

Relationship of Borrowed Reserves to Spread between Federal Funds Rate and Discount Rate

January 1959 - August 1990

Borrowed reserves in millions

Spread in basis points
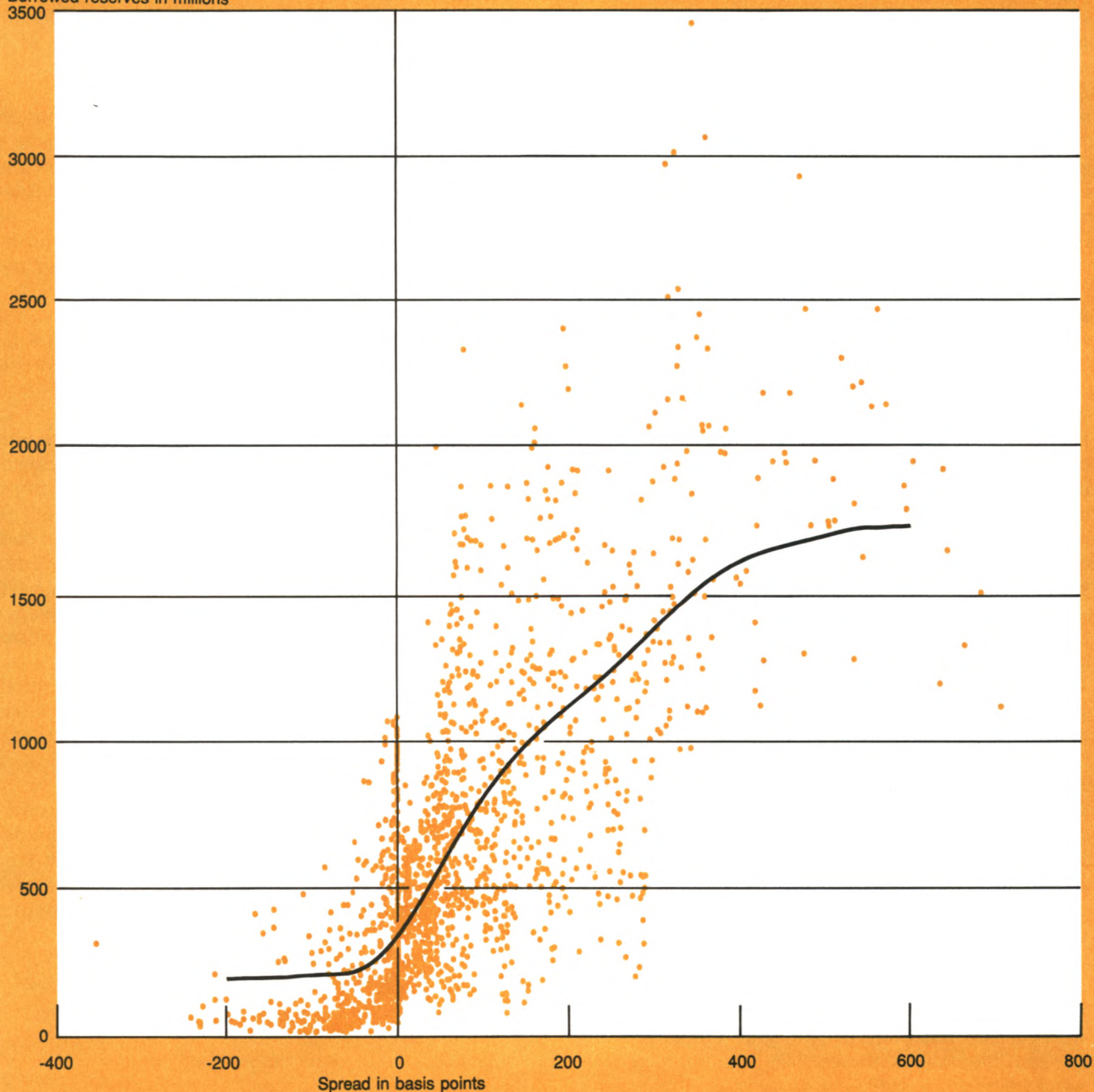
Source: Board of Governors of the Federal Reserve System.

Note: The plotted curve represents predicted borrowed reserves obtained from a nonlinear regression model of the spread. Borrowed reserves consists of adjustment plus seasonal borrowing. The series is adjusted for irregularities in bank borrowing.

though a bank may be willing to visit the discount window, it is not permitted to borrow unlimited amounts of funds. For example, as a general rule, it is inappropriate for a bank to be a net seller of federal funds while borrowing. Alternatively, a bank may not have enough collateral immediately available to secure a large borrowing at the Federal Reserve.[4] Thus, in principle, there exists an upper bound on a bank's borrowing ability that could be less than its notional demand for discount credit. In the current framework, notional demand, B_{ti}^{*d} would equal observed borrowing, B_{ti}^{d}, only when the bank's notional demand exceeds its borrowing threshold and is less than its effective upper bound, should one exist. Individual bank behavior was estimated by the following regression equation:

(1) $\quad B_{ti}^{*d} = \beta_0 + \beta_1 S_t + \beta_2 (\hat{S}_{t+2} - S_t) + \beta_3 \Delta \text{Yield}_t + \gamma B_{t-1,i}^d + u_{ti},$

where B_{ti}^{*d} is notional demand measured as the average daily amount borrowed over the week t.[5] Ordinarily, estimating an individual bank's notional demand for borrowing requires knowing the upper and lower constraints. Unfortunately, these limits are not known. As shown in the appendix, however, the constant term, β_0, can be interpreted to measure the true constant term of the equation (which is greater than or equal to zero because banks cannot lend to the window) as well as the effects of both the threshold and the upper constraint described above. Moreover, since both bounds work to bias downwards only the estimated constant term of the regression, this specification allows for the unbiased estimation of all the exogenous factors influencing individual bank demand for adjustment credit. The algebra in the appendix shows that if the threshold and upper constraint are important behaviorally, then we would expect the estimated constant terms to be significant and negative.

The remaining specification is quite standard. The spread of the weekly effective federal funds rate over the discount rate, S_t, measured in basis points, represents the opportunity cost of borrowing from the window. Of course, each bank's opportunity cost of borrowing is not exactly equal to this interest rate

spread; some banks pay more and some pay less. However, their average cost of reserves is probably well represented by the effective funds rate, which is a volume-weighted average. At the very least, the rate spread is an unbiased proxy for the banks' cost of reserves and shows how this cost changes from week to week. On average, we would expect this coefficient estimate to be positive, because the larger the spread, the lower the relative cost of adjustment credit and therefore the higher the notional demand for it.

Recently, it has been argued persuasively that banks' use of the discount window is also a function of their expectations about the future level of interest rates.[6] Optimizing banks will conserve their borrowing privilege and forgo borrowing today in order to visit the window during those future periods when the alternative cost of borrowing is expected to be highest. To incorporate this intertemporal aspect of adjustment demand, we include a measure of the expected change in the federal funds–discount rate spread, $(\hat{S}_{t+2} - S_t)$.[7] If a bank does optimize the use of its privilege over time, then the estimated coefficient β_2 should be negative.

Lagged discount window borrowing, $B_{t-1,i}^d$, is also included as an explanatory variable. If banks believe that they deplete their privilege when they borrow, then the estimated coefficient, γ, should be negative. This result may not, however, hold empirically for smaller banks. Discount officers recognize that smaller institutions have more limited access to national money markets than do their larger counterparts. Consequently, smaller banks are given more leeway in their access to the window. For example, money-center and other larger banks are usually expected to need assistance for only a single day (not including holidays or weekends). By contrast, smaller banks may need to borrow over a number of days. For these banks, a single decision to borrow may end up being observed over two consecutive periods and may lead to positive serial correlation.

For technical reasons, general market and economic conditions should be modeled parsimoniously. Hence

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[4]The Federal Reserve requires that all extensions of discount window credit be secured to its satisfaction. Assets that are suitable collateral include U.S. government and agency securities, municipal and corporate securities, customer notes based on commercial and agricultural loans, residential real estate notes, and bankers' acceptances. In most instances the collateral is kept at the Federal Reserve Banks.

[5]For instance, if $70 million was borrowed only for Tuesday, then
$$B_{ti}^d = \frac{0+0+0+0+0+70+0}{7} = \$10 \text{ million.}$$

[6]See Marvin Goodfriend, "Discount Window Borrowing, Monetary Policy, and the Post-October 6, 1979 Federal Reserve Operating Procedure," *Journal of Monetary Economics*, vol. 12 (September 1983), pp. 343-56.

[7]The expectation was led forward by two weeks to account for the biweekly reserve maintenance period since 1984. Moreover, the prediction was utilized in differenced form because $\hat{S}_{t+2}$ was highly collinear with S_t. We experimented with other variations that led the prediction by only one week prior to 1984, and the results were essentially similar. The expectation $\hat{S}_t$ was calculated in a standard way from an autoregressive model that included a host of commonly accepted explanatory variables: lags of the federal funds–discount rate spread, the repurchase agreement–federal funds rate spread, and growth in the monetary aggregates.

these factors are proxied very simply by the slope of the Treasury yield curve, as given by the spread of the thirty-year Treasury bond rate over the bond equivalent three-month Treasury bill rate, $\Delta Yield_t$. This variable can be viewed as a simple control variable that allows the behavioral parameters to be measured more efficiently.

Some features of the data should be noted. Because the model describes notional adjustment credit behavior, the sample is restricted to banks that visited the window at least once in six of the possible ten years and that made minimal use of the seasonal and extended credit facility.[8] This restriction yields a consistent sample of 240 commercial banks. The data are weekly observations of daily average adjustment credit borrowing for the period January 1981-August 1990.[9]

Empirical findings
Although the estimation was done at the disaggregate level, the results are presented in summary form to preserve the confidentiality of the data on individual banks. But because smaller institutions—those with assets less than or equal to $1 billion during the first half of 1990—seem to behave differently than larger banks, we present the summary statistics for the two size classifications in separate tables (Tables 1 and 2). In both tables, the first column presents the group average of the estimated coefficient. The coefficient estimates are scaled by dividing the coefficient by each bank's average level of borrowings. Otherwise, larger banks, which tend to borrow considerable amounts because of their size, would exhibit larger unscaled coefficients even though their behavioral response, in a relative statistical significance sense, may not be differ-

ent from that of a much smaller bank. For the sample, the larger banks' average level of daily borrowing ($28 million) is fourteen times as large as the smaller banks' level ($2 million). Columns 2 and 3 give the percent of the sample of banks that have a positive or negative coefficient value. Columns 4 and 5 provide a representative range of the coefficient values.

Consistent with the model described in the appendix, all the banks, regardless of size, exhibit a negative constant term. If we assume that banks are generally not upper-bound constrained, the estimated constant in Table 1 suggests that smaller banks have borrowing threshold levels that are almost two and one-half times as large as their actual level of average borrowings. For example, suppose that a bank's average level of observed daily borrowings at the window is $2 million. Then its notional demand must on average exceed $5 million before the bank would be willing to come to the window. But even among smaller institutions the range of responses is quite wide (columns 4 and 5 of Table 1). Some banks' threshold levels are virtually nonexistent, while the levels of others are more than double that of their group's average.

After size is taken into account, larger banks with assets greater than $1 billion have somewhat higher threshold levels than do smaller banks (Table 2, row 1). Thus a bank that averages adjustment borrowing of $30 million will need to have notional demand in excess of $85 million before it will consider coming to the window. After this size effect is taken into account, a simple t-test indicates that the larger banks' threshold is significantly higher, but only marginally so (p − value = 0.069).

Our findings suggest that smaller banks for the most part respond positively to a widening of the federal funds–discount rate spread (Table 1, row 2).[10] When the spread widens by 100 basis points, the banks' notional demand increases by 20 percent of their average level of borrowing. Larger banks are somewhat more sensitive to a widening of the spread (Table 2, row 2). A 100 basis point widening increases their notional demand by 25 percent of their average level of borrowing.

Testing the effect of expectations of future interest rate changes on the demand for adjustment borrowing produces the most mixed evidence for both groups of banks. The majority of banks in each sample have negative coefficients, indicating that the banks are making some attempt to optimize intertemporal use of the

[8]Because we were modeling adjustment borrowing behavior, we tried to limit our sample to banks that had made minimal use of other types of borrowing. The six-year cutoff reflects a balance between including large banks in the sample and having a sufficient number of noncensored observations per bank to make the statistical estimation viable. Other cutoff levels were tried, and the results were found to be robust.

[9]The model was estimated by an EM-algorithm procedure that is equivalent to maximum likelihood estimation. (See Takeshi Amemiya, *Advanced Econometrics* [Cambridge: Harvard University Press, 1985], pp. 375-78, for a more detailed description.) In other words, 240 separate equations, one for each bank, were estimated for the sample period. Censored regression models frequently have a large percentage of censored (zero) dependent observations. In the present sample, the average value of censoring was 93 percent, although in some extreme cases it was as high as 98 percent. Alternatively, banks had an outstanding loan balance 7 percent of the time on average. Maximum likelihood estimation projects all censored (zero) observations on a hypothesized normal distribution structure. The technique is most suitable for assessing the primary motives of the notional behavior; thus it is important that the employed explanatory variables provide a reasonable specification. For this reason, we limited our estimation to a parsimonious specification.

[10]The interest rate spread variable was not adjusted in the individual bank equations to reflect the surcharge because such data were not available. This omission should not be a problem because the surcharge was actually triggered in only 9 weeks of the 501-week sample period. Moreover, surcharge corrections to the aggregate borrowing function typically are not significant.

Table 1

Estimates of Individual Borrowing Function for Banks with Assets Less Than or Equal to One Billion Dollars
Summary Statistics

Borrowing Function: $B_t^* = \beta_0 + \beta_1 S_t + \beta_2(\hat{S}_{t+2} - S_t) + \beta_3 \Delta \text{Yield}_t + \gamma B_{t-1}$

Coefficient	Mean	Percent Positive	Percent Negative	First Percentile	Ninety-ninth Percentile
$\frac{\beta_0}{\bar{B}}$	−2.54[−28.47*]	0	100	−6.352	−0.223
$\frac{\beta_1}{\bar{B}}$	0.0020[11.43*]	79	21	−0.0039	0.0081
$\frac{\beta_2}{\bar{B}}$	−0.00036[−1.31]	48	52	−0.0010	0.0091
$\frac{\beta_3}{\bar{B}}$	0.0027[17.06*]	96	4	−0.0015	0.0114
$\hat{\gamma}$	0.261[15.79*]	87	13	−0.405	0.679

Notes: Number of banks with assets less than or equal to $1 billion is 184. The time series sample consists of weekly observations from January 1981 to August 1990, a total of 501 observations. The variable $\bar{B}_j$ $(j = 1,...,184)$ represents average outstanding adjustment borrowing of the j-th bank over the weekly sample. Numbers in brackets are t-statistics for the null hypothesis that $(\frac{\beta}{\bar{B}}) = 0$.

  B_t^* = average outstanding adjustment borrowing (millions of dollars)
  B_t = max{0,B_t^*} (see equation system A.2 in the appendix)
  S_t = federal funds–discount rate spread (basis points)
  $\hat{S}_t$ = federal funds–discount rate predicted spread (basis points)
  ΔYield_t = spread between thirty-year Treasury bond rate and three-month bill rate (basis points).

*Statistically significant at the 5 percent level.

Table 2

Estimates of Individual Borrowing Function for Banks with Assets Greater Than One Billion Dollars
Summary Statistics

Borrowing Function: $B_t^* = \beta_0 + \beta_1 S_t + \beta_2(\hat{S}_{t+2} - S_t) + \beta_3 \Delta \text{Yield}_t + \gamma B_{t-1}$

Coefficient	Mean	Percent Positive	Percent Negative	First Percentile	Ninety-ninth Percentile
$\frac{\beta_0}{\bar{B}}$	−2.85[−19.50*]	0	100	−5.030	−0.365
$\frac{\beta_1}{\bar{B}}$	0.0025[7.78*]	86	14	−0.0025	0.0084
$\frac{\beta_2}{\bar{B}}$	−0.0085[−2.0*]	39	61	−0.0099	0.0052
$\frac{\beta_3}{\bar{B}}$	0.0031[12.64*]	96	4	−0.00024	0.0085
$\hat{\gamma}$	−0.206[3.89*]	35	65	−1.445	0.470

Notes: Number of banks with assets greater than $1 billion is 56. The time series sample consists of weekly observations from January 1981 to August 1990, a total of 501 observations. The variable $\bar{B}_j$ $(j = 1,...,56)$ represents average outstanding adjustment borrowing of the j-th bank over the weekly sample. Numbers in brackets are t-statistics for the null hypothesis that $(\frac{\beta}{\bar{B}}) = 0$.

  B_t^* = average outstanding adjustment borrowing (millions of dollars)
  B_t = max{0,B_t^*} (see equation system A.2 in the appendix)
  S_t = federal funds–discount rate spread (basis points)
  $\hat{S}_t$ = federal funds–discount rate predicted spread (basis points)
  ΔYield_t = spread between thirty-year Treasury bond rate and three-month bill rate (basis points).

*Statistically significant at the 5 percent level.

window. This finding applies in particular to the bigger banks. Typically liability-managed institutions with ready access to national money markets, the bigger banks seldom need to borrow for more than occasional overnight needs. Hence, they must consider not only whether to borrow but also in which period to deplete their window privilege. If larger banks expect the spread to fall 10 basis points in the next maintenance period, they will increase their notional demand by less than 9 percent of their average level of borrowings (Table 2, row 3). Alternatively, when rates are expected to rise, banks tend to delay exhausting their window privilege. Thus the rate spread affects the notional demand for adjustment borrowing through two channels: its current level, β_1, and its anticipated change for the next period, β_2. For example, if the current federal funds–discount rate differential is 100 basis points but is expected to narrow in the next period by 10 basis points, then large banks' notional desire for the current period will increase by about 34 ($= 25 + 9$) percent of their average level of borrowings, all else equal.

The most striking difference in discount window behavior between larger and smaller banks appears in the lagged borrowing coefficient. When smaller banks develop a liquidity need, it takes them some time to adjust their positions because of their more limited access to money markets. Recognizing this special circumstance, window officers allow such banks to borrow over several periods. Hence their borrowings are positively serially correlated. On average, 27 percent of current borrowings may arise from this adjustment process. In contrast, the majority of larger banks have a negative coefficient. When these banks utilize their privilege, their notional demand for adjustment credit in the subsequent period falls on average by 21 percent because they recognize that the Federal Reserve discourages sequential visits.

The aggregate borrowing relationship

Our estimates of the individual borrowing functions enable us to examine the implications of individual bank behavior for the aggregate level of adjustment credit. In particular, we simulate individual demand functions and show that the implied aggregate borrowings exhibit the same general pattern and data anomalies as actual aggregate borrowings. A different simulation is done to illustrate each anomaly separately.[11]

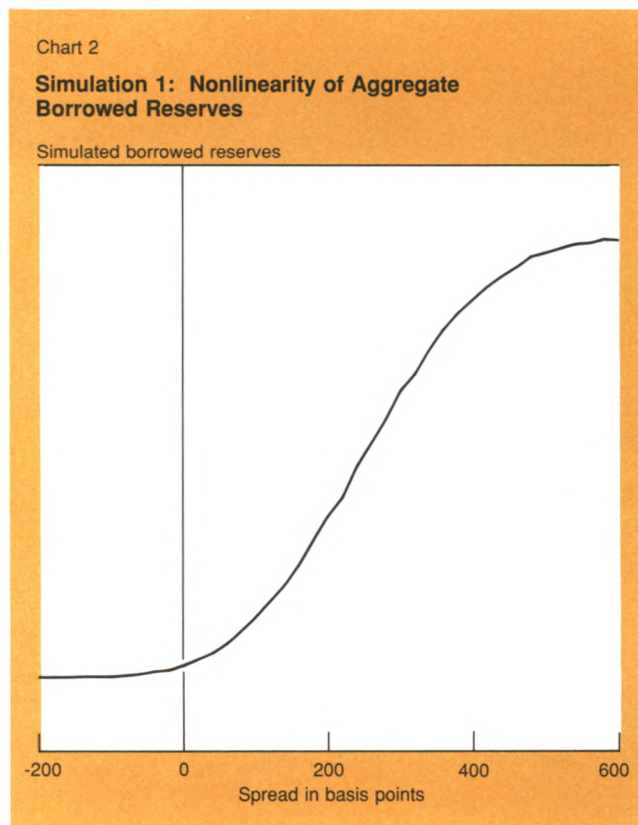*Simulation 1: aggregate borrowing nonlinearity*
To show that nonlinearity can arise merely from varia-

tions in banks' borrowing thresholds and upper bounds, we assume that banks are identical except for these two constraints. More specifically, we assume:

$$B_{ti}^{*d} = 2 + 0.01S_t,$$

where S_t again denotes the federal funds–discount rate spread. The parameter values are selected to approximate those of the empirical findings. For example, we found that the average of the unscaled coefficient for the interest rate spread, β_1, is about 0.04 for the large bank group and 0.002 for banks with assets less than or equal to $1 billion. The value of 0.01, utilized in our simulations, is a weighted average of the various β_1 estimates. The other parameter values and random shocks are chosen similarly. Individual banks' differing thresholds and upper bounds are given by $I_{ti} = 4 + 1.8\zeta_{ti}$ and $C_{ti} = 5 + 1.2\zeta_{ti}$, respectively, where each ζ_{ti} is randomly drawn from a standard normal distribution.

Chart 2 shows the aggregate borrowing relationship that is the sum of 2,000 such simulated demand functions—a general approximation of the number of weekly reporting banks that visit the window during the sample period. At very low levels of the spread, most banks' notional demands for adjustment credit are less than their individual minimum thresholds, and therefore

Chart 2

Simulation 1: Nonlinearity of Aggregate Borrowed Reserves

Simulated borrowed reserves

Spread in basis points

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[1]For a specific proof of the statistical traits of the aggregate borrowed reserves, see Stavros Peristiani, "The Model Structure of Discount Window Borrowing," *Journal of Money, Credit, and Banking*, vol. 23 (January 1991), Section 2, pp. 13-34.

they do not come to the window. As the spread widens, however, the opportunity cost of borrowing from the window also rises and individual banks' notional demands for adjustment credit increase. Progressively, more and more banks cross their minimum borrowing thresholds and come to the window to meet their reserve needs. At very high levels of the spread, individual banks may start encountering their upper constraints, and therefore the sensitivity of aggregate borrowings to the spread declines. The S-shaped nonlinear profile of Chart 2 suggests that even if all borrowers had identical notional demands, nonlinearity in the aggregate relationship would still arise because of variations in banks' responses to the implicit cost of discount window borrowing.

Simulation 2: aggregate borrowing variability
To demonstrate that the variability of total borrowings increases with the number of borrowers, we allow individual banks to differ in their response sensitivity to the spread variable and to have their own stochastic element. More specifically, it is assumed that

$$B_{ti}^{*d} = 2 + (0.01 + 0.003\xi_i)S_t + u_{ti},$$

where $u_{ti} = \zeta_{ti}$ and ξ_i are again randomly drawn from a standard normal distribution. For comparability, we maintain the threshold and upper-bound values of simulation 1. In other words, for every period, a random shock is added to the bank's notional demand as well as its threshold and upper limit. For greater realism, the spread values are more frequently in the range of 0 to 200 basis points. Chart 3 depicts a scatter plot of aggregate borrowing derived from 2,000 such simulated borrowing functions.

This exercise also shows the aggregate relationship to be nonlinear. In Chart 3, we fit the same aggregate borrowings function to the generated data as was fit to the actual data of Chart 1. Using the R-square coefficient as a criterion of comparability, we find that the nonlinear specification for the generated data yields an R^2 value of .89, while the actual data R^2 value was .81. Hence the generated data are nonlinear in a way that is very similar to the actual data.

Chart 3 also shows a funnel configuration to the data points that is very like the configuration of Chart 1. The statistical literature terms this type of data pattern "heteroskedasticity," and a number of formal statistical tests are proposed for detecting its presence. The computed chi-square test values for the two data sets are both significant and very similar in value (167 for the actual data and 188 for the generated data). At wider spreads, more banks have crossed their minimum borrowing threshold and therefore are willing to come to the window to meet their borrowing need. But as more heterogeneous borrowers come to the window, the cumulative

impact of their differences manifests itself as increased variability of aggregate adjustment borrowing.[12] Thus, the greater variability of aggregate borrowings that we see in actual borrowings can arise from behavioral variation across banks and randomness in the banks' notional demands for borrowing.

Conclusion
When plotted against the federal funds–discount rate spread, discount window borrowing exhibits a puzzling pattern. Researchers have tried to explain this relationship in a number of ways, but almost always at the aggregate level. We take a different approach by modeling individual bank behavior to reflect discount window administration. We assume that banks have a continuous notional demand for adjustment credit that is a function of the federal funds–discount rate spread and other variables. But because the window is administered as a privilege and not as an automatic right, banks do not come to the window until their notional demand exceeds some minimum or threshold level. Hence low levels of their notional demand will not be observed, so that actual borrowings and the aggregate borrowings function will tend to be flat for low levels of the spread. Similarly, banks may sometimes be unable to borrow as much as they ideally would like at high levels of the spread. Hence high levels of notional demand will also not be readily observed as actual borrowings. As a consequence, the aggregate borrowings function will tend to flatten out at high levels of the spread as well. This pattern is in fact what a scatter plot of actual adjustment borrowings shows. Thus the nonlinearity of the aggregate borrowings function derives from banks' responses to the fact that the window is administered as a privilege and not as an automatic right.

The funnel shape of the data stems from a related source. The behavioral parameters that determine notional borrowing differ from one bank to the next. As the spread between the federal funds rate and the discount rate widens, notional demands also increase, but to varying degrees. More and more institutions are likely to come to the window as the spread widens further. Hence high levels of aggregate borrowing usually arise because a greater number of disparate institutions are coming to the window. The presence of diverse banks, each with its own idiosyncratic behavior, causes the aggregate borrowings function to be more variable at high levels of the spread.

Our disaggregate approach gives an insight into total

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[12]In statistical language, the variance of total borrowings is the sum of the individual bank variances plus their covariances. Since the covariances are equal to zero, the variance of total borrowings increases with the number of borrowers.

Chart 3

Simulation 2: Variability in Aggregate Borrowed Reserves

Simulated borrowed reserves

Spread in basis points

-400   -200   0   200   400   600   800
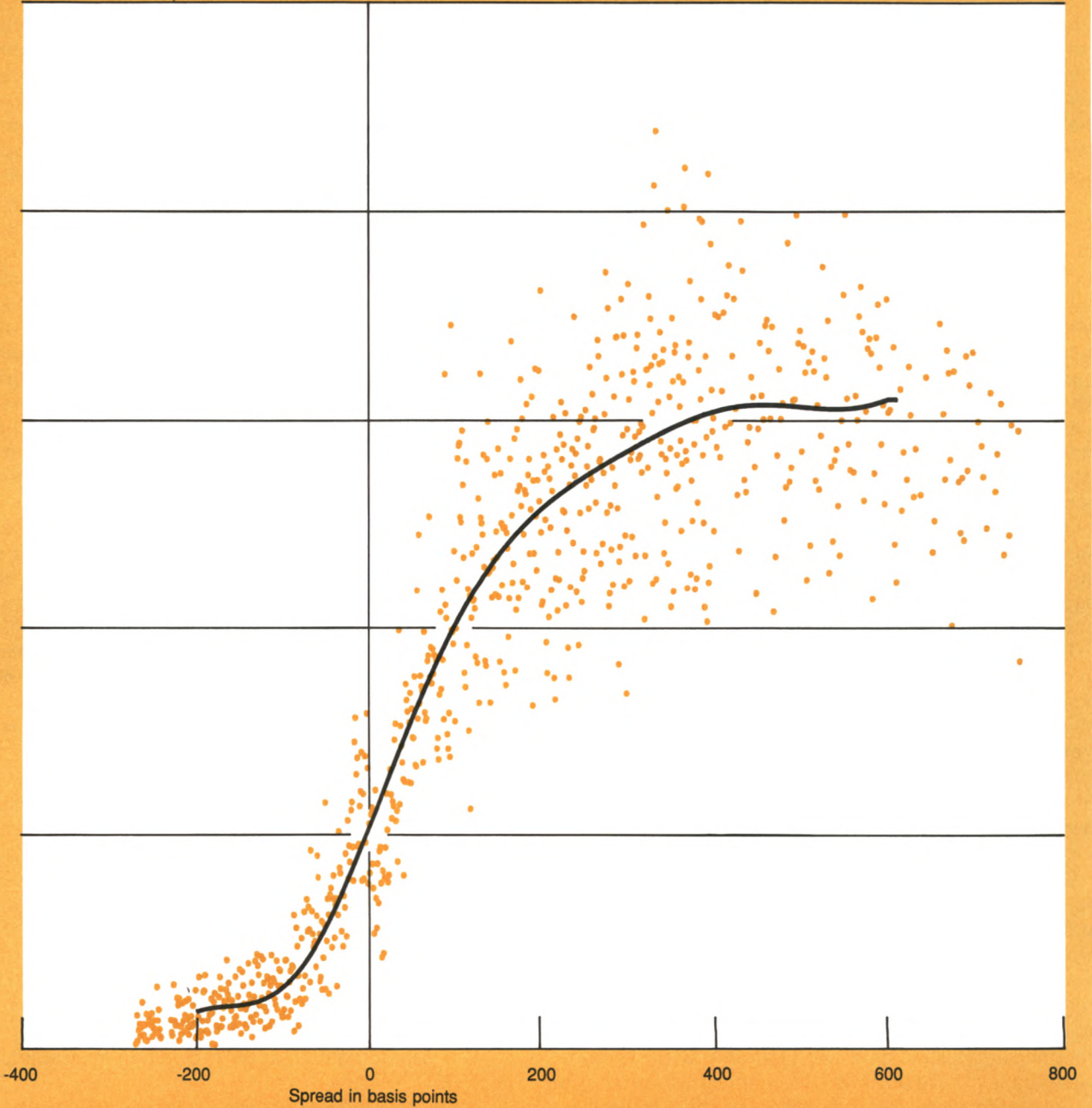
Note: The plotted curve represents predicted simulated aggregate borrowing obtained from a nonlinear regression model of the spread.

discount window borrowing that cannot be easily obtained by studying the relationship at the aggregate level exclusively. Although this approach may not help predict total borrowings any more precisely, it does explain why the relationship is nonlinear and more variable at high levels of the spread. The variability is endogenous to the process and not necessarily due to some episodic instability.

Appendix

Individual bank behavior at the discount window can be formalized by adapting a censored behavior model. In this framework, a reservation or threshold level must be exceeded, ceteris paribus, before the bank will actually use its window privilege.

We assume that individual banks have a notional demand for discount window credit, denoted by B_{ti}^{*d} which is a function of their reserve needs and the cost of reserves. In practice, however, unlimited access is not possible because the window is administered as a privilege rather than an automatic right. Borrowers are expected to seek other reasonably available sources of funds before turning to the window for assistance, and credit is granted at the discretion of the Reserve Bank. In effect, these restrictions introduce a nonprice consideration to discount window use. Consequently, the bank's notional demand is different from its effective demand, which is observed as actual discount window borrowing.

To model the nonprice aspects of discount window borrowing, we assume that each bank has an unobserved reservation level of borrowing, l_{ti}, that depends on the extent of recent discount window usage (the frequency of visits, the size of the borrowings, the number of consecutive visits) and on other possible economic variables. Similarly, we assume that banks may not be able to borrow as much as they ideally would like. For example, the Federal Reserve requires that all discount window loans be secured. Although banks customarily maintain collateral at Federal Reserve Banks, some banks may not have enough eligible collateral immediately available in a given time period to support a large notional borrowing need. We term those institutions that are not borrowing as much as they ideally would like "collateral constrained" (even though the constraint does not always arise from a scarcity of collateral). The variable C_{ti} denotes this upper bound on a bank's borrowing ability.

Demand for discount window credit can by described by the following equation system:

(A.1.1) $B_{ti}^{*d} = s_t \beta_i + u_{ti}$

(A.1.2) $l_{ti} = z_t \delta_i + \epsilon_{ti}$

subject to:

(A.1.3)

$$
\begin{aligned}
B_{ti}^d &= C_{ti} &&\text{if} &&B_{ti}^{*d} \geqslant C_{ti} &&i = 1,\ldots,n_t^c \\
&= B_{ti}^{*d} &&\text{if} &&l_{ti} < B_{ti}^{*d} < C_{ti} &&i = n_{t+1}^c,\ldots,n_t \\
&= 0 &&\text{if} &&\text{otherwise} &&i = n_{t+1},\ldots,N_t.
\end{aligned}
$$

Notional demand, B_{ti}^{*d} consists of a systematic component, s_t, which may include a variety of economic variables, and a random component, u_{ti}. For example, a very simple formulation would let the systematic component s_t consist solely of the spread of the federal funds rate over the discount rate.[†] The unobserved reservation borrowing level, l_{ti}, is assumed to depend on a number of explanatory variables represented by the vector, z_t, and a random component, ϵ_{ti}. The parameters β_i and δ_i describe individual bank behavior. Note that these parameters are unrestricted. The variable N_t represents the total number of banks that are eligible to borrow at the window in period t, while n_t is the number of banks that actually borrow in period t and n_t^c is the number of borrowing banks that borrow up to their collateral limit.

The first constraint of A.1.3 specifies that if the bank is collateral constrained, then its observed demand for borrowing will be equal to the value of its collateral or perceived upper bound. The third constraint indicates that the observed demand will be equal to zero if the notional demand is below the reservation threshold. If the bank is neither collateral constrained nor below its reservation level, then the observed level of borrowing will be an accurate measure of its notional demand for discount window credit.

The advantage of equation system A.1 is that it realistically allows notional demands to be continuous while observed or effective demands are discontinuous. In this model, notional demand, B_{ti}^{*d} is observed as actual demand, B_{ti}^d, only when the notional demand is greater than the implicit reservation of borrowing, l_{ti}. Thus, when banks do not visit the discount window, it is not because the desired amount of credit is zero but because the amount is below the implicit reservation threshold. This threshold is in turn determined by the banks' recent use of the discount window and by pre-

†The variable s_t is a vector that includes all explanatory information. For instance, in the case of equation 1 of the main text, s_t is equal to $(1, S_t, \hat{S}_{t+2} - S_t, \Delta \text{Yield}_t, B_{t-1,i}^d)$.

vailing and future economic conditions.‡

The equation system given by A.1 could be estimated directly by a two-limit sample selectivity maximum likelihood algorithm. Unfortunately, the two limits, C_{ti} and I_{ti}, are not observed. One practical alternative is to allow for a deterministic reservation index and upper collateral bound such as $(I_{ti} = \bar{I}_i, C_{ti} = \bar{C}_i)$. With these simplifications, the model is reduced to the simple censored regression:

(A.2.1) $\quad B_{ti}^{*d} = s_t \beta_i + u_{ti}$

subject to:

(A.2.2)

$$
\begin{aligned}
B_{ti}^d &= \bar{C}_i & \text{if} && B_{ti}^{*d} &\geq \bar{C}_i & i &= 1, \ldots, n_t^c \\
&= B_{ti}^{*d} & \text{if} && \bar{I}_i &< B_{ti}^{*d} < \bar{C}_i & i &= n_{t+1}^c, \ldots, n_t \\
&= 0 & \text{if} && \text{otherwise} && i &= n_{t+1}, \ldots, N_t.
\end{aligned}
$$

Equation system A.2 appears to impose a fairly crude solution to these apparent unobservables. Even so, we will show that this specification is still capable of capturing the basic effects. Assuming that $C_{ti} = \bar{C}_i$ is somewhat problematic because we are unable to identify observations that reach the collateral limit. The lower threshold, $\bar{I}_i$, is less troubling; although the value of the outcome is not observed, the action is identifiable from the bank's borrowing activities.

The unobservability of both $\bar{I}_i$ and $\bar{C}_i$ poses no significant problems for the estimation because it introduces only a downward bias on the constant coefficient β_{0i}. Let us assume that $s_t = (1, S_t)$. That is, banks arrive at their decision to borrow only by looking at the federal funds–discount rate differential. To estimate the parameters of the model given by equation system A.2, we need to define the likelihood function of the system. The first component of the likelihood reflects the probability that a bank will not borrow in that particular week. More precisely,

$$
\begin{aligned}
P(B_{ti}^* - \bar{I}_i \leq 0) &= P(\beta_{0i} + \beta_{1i} S_t - \bar{I}_i \leq -u_{ti}) \\
&= P(u_{ti} \leq -\beta_{0i}^I - \beta_{1i} S_t),
\end{aligned}
$$

where $\beta_{0i} = \beta_{0i}^I - \bar{I}_i$. The second component of the likelihood represents the possibility that a bank will borrow the maximum allowable. As in the previous case, it can be shown that this is equivalent to

$$P(B_{ti}^{*d} - \bar{C}_i \geq 0) = 1 - P(u_{ti} \leq -\beta_{0i}^C - \beta_{1i} S_t),$$

where $\beta_{0i}^C = \beta_{0i} - \bar{C}_i$. The third component of the likelihood accounts for the possibility that the i-th bank will borrow at period t an amount not equal to the collateral limit. Specifically, the likelihood of the system can be defined by:

$$
L = \prod_{t=n_t+1}^{N_t} P(u_{ti} \leq -\beta_{0i}^I - \beta_{1i} S_t) \prod_{t=n_t^c+1}^{n_t} f(\beta_{0i}, \beta_{1i}, \sigma_i; S_t)
$$

$$
\prod_{t=1}^{n_t^c} [1 - P(u_{ti} \leq -\beta_{0i}^C - \beta_{1i} S_t)].
$$

An interesting detail of the likelihood is that β_{0i}, the usual constant parameter, is affected by the unknown levels of $\bar{I}_i$ and $\bar{C}_i$. Because a bank will not be at the window most of the time, the maximum likelihood estimate of β_{0i} will reflect more β_{0i}^I; thus, the final constant estimate should be expected to achieve a large negative value. Note that even when the bank borrows, the negative bias does not disappear, because the constant parameter for the cases that reach the upper limit is represented by β_{0i}^C. Since the collateral limit C_i is unavailable, the last component of the likelihood is not measurable. One solution to this problem is to assume no implicit collateral constraint, a step that would in turn constrain the probability of the third component of the likelihood to 1. Despite all the apparent biases imbedded in the constant coefficient, in all three segments of the likelihood the slope coefficient β_1 is uncontaminated. This finding means that we can obtain unbiased measures of the association between notional borrowing and the federal funds–discount rate spread or any other explanatory variable. Another minor difficulty introduced by equation system A.2.2 is the assumption that banks are always supplied with the amount requested $(B_{ti}^{*d} = B_{ti}^d)$. In general, there is no guarantee that visiting banks will invariably be granted the full amount $B_{ti}^{*d} = B_{ti}^d$. Given the available information, however, it is not feasible to separate these minor residual deductions from the observed amount of individual borrowing.

The Trade Balance Effects of Foreign Direct Investment in U.S. Manufacturing

by James Orr

Rising foreign direct investment in U.S. manufacturing during the 1980s has increased the number and importance of U.S. affiliates of foreign firms. In particular, the large investment inflows of the latter half of the decade have made these affiliates potentially important sources of improved industry competitiveness. Over the long term, the presence of foreign-owned firms may strengthen the international trade position of U.S. manufacturing. Significant shares of the assets of several industries heavily involved in international trade are now under foreign control. Moreover, countries that are major international competitors of the United States, notably Japan, have made large investments in a number of these industries. In fact, some observers contend that the highly competitive U.S. affiliates of Japanese multinationals will substantially reduce the large U.S.-Japan bilateral trade deficit by the mid-1990s.

This article examines the extent to which the growth in overall foreign ownership of U.S. manufacturing firms is likely to improve the U.S. trade balance over the longer term. Foreign ownership may be expected to improve the trade balance for several reasons. Production in U.S. affiliates of foreign multinational corporations could potentially displace imports from either foreign parent companies or other foreign suppliers. More important, the "supply-side" effects of foreign direct investment (FDI), including the transfer of technological or other competitive advantages from foreign parents to their U.S. affiliates, could expand U.S. exports. As with most investments, these improvements in productivity and international competitiveness would only be observed over time.

The impact of the recent increase in FDI on the U.S.

trade balance is analyzed in two steps. First, a standard trade model is used to estimate the broad economywide effect of FDI. Second, four manufacturing industries that are important for U.S. trade performance and that have had sizable inflows of foreign capital—automobiles, steel, electronics, and chemicals—are individually examined to obtain a more detailed picture of FDI's influence across sectors. Evidence from these case studies is combined with the estimates from the standard trade model to derive an estimate of the long-run effect of FDI on the trade balance.

The evidence from this two-step analysis suggests that the growth in foreign ownership of U.S. firms will improve the U.S. trade balance in the longer term. More specifically, the eventual trade balance improvement attributable to the rapid increase in foreign investment in the second half of the 1980s is estimated to be on the order of $25 billion. Exports will be permanently higher by about $15 billion annually, while imports will be about $10 billion lower. The full impact of the FDI flows on U.S. trade, however, will not be fully realized for several years. This lag reflects the relatively long time required for competitiveness improvements arising from FDI to be observed in trade flows.

The first section of the article outlines the growth of foreign ownership of the U.S. manufacturing sector in general and the traded goods industries in particular. The section also highlights the characteristics of the recent FDI flows that are most likely to determine the longer term impact of foreign investment on the U.S. trade balance. The next section presents the trade model estimates of the effects of FDI on aggregate U.S. exports and imports. The analysis is then supple-

mented with an examination of the effects of FDI on trade performance in four individual manufacturing industries. The concluding sections of the article summarize the findings and assess the potential for longer term trade balance improvement.

Overview of foreign direct investment and its likely impact on the U.S. trade balance

The stock of FDI in the United States grew at a particularly rapid pace during the latter half of the 1980s. Between 1985 and 1989, FDI flows averaged just over $50 billion annually, and roughly half of that investment went into manufacturing industries (Chart 1).[1] In 1990 FDI slowed but was still estimated to have increased by $25 billion. The 1990 book value of the total stock of FDI reached $426.5 billion; $173.5 billion, or roughly 40

[1]For a discussion of the issues surrounding the collection and reporting of FDI data and additional details on FDI flows into the United States, see James Orr, "Foreign Direct Investment in U.S. Manufacturing: Effects on the Trade Balance," Federal Reserve Bank of New York, Working Paper no. 9032, September 1990.
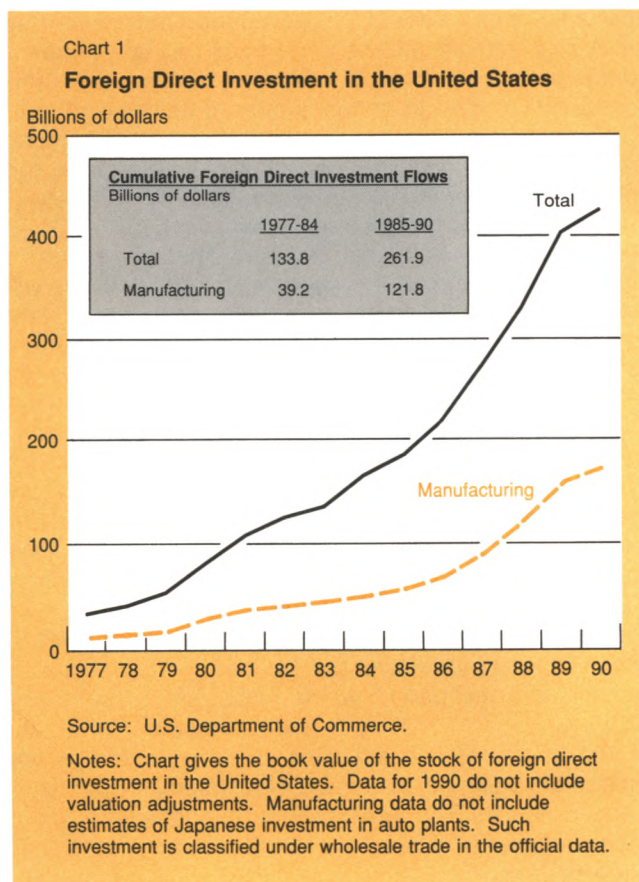
percent, of that amount was in manufacturing.[2]

Several features of this rapid growth in foreign control of U.S. manufacturing assets during the latter half of the 1980s suggest the specific channels by which FDI is likely to influence the trade balance. First, with the exception of Japanese investors who established new automobile assembly plants in this country, foreign investors generally entered the U.S. market by acquiring existing U.S. firms rather than by setting up new firms. On average, more than 93 percent of annual foreign investment outlays in manufacturing during this period were for acquisitions.[3] Because transferring ownership of existing facilities does not add directly to an industry's productive capacity, FDI through acquisitions is not likely to lead to an immediate and significant displacement of imports or an expansion of exports.

Committing substantial financial resources to acquire existing production facilities, however, does imply that foreign owners expect to improve the profitability of acquired U.S. firms. Indeed, the large FDI flows during the latter half of the 1980s were an increasingly important source of U.S. investment, especially in the manufacturing sector, where they accounted for over 15 percent of annual plant and equipment spending (Chart 2).[4] Furthermore, the share of new capital spending by foreign-owned firms in overall new capital spending in manufacturing during the 1980s rose faster than the

[2]The analysis in this article uses book value estimates of FDI. The Department of Commerce has recently revised its estimates of FDI in the United States to reflect current-period asset prices. The current-cost estimate of the stock of FDI in 1990 was $465.9 billion, while the market value estimate of the stock of FDI in 1990 was $530.4 billion. Because the new estimates are only available beginning in 1982 and are not broken down by either industry or source country, they are of limited use for this analysis. Furthermore, the annual changes in FDI stock based on current-cost estimates follow a pattern similar to the book value measures, while annual changes based on market values fluctuate widely and are not consistent with either book values or current-cost measures.

[3]The investment outlays cited here differ from FDI measures reported in the balance of payments accounts in two ways. First, they refer to the total value of the investment rather than to the amount financed by the foreign parent. Second, they comprise only expenditures to acquire existing firms or to establish new businesses. The data exclude expenditures by U.S. affiliates to expand existing facilities. Unofficial Department of Commerce tabulations of investment spending announcements by both new and existing foreign-owned firms, regardless of the source of financing, show a comparatively large share of outlays to establish new plants and expand existing plants. See U.S. Department of Commerce, International Trade Administration, "Foreign Direct Investment in the United States, 1988 Transactions," October 1989, for a tabulation of announced investment activities of U.S. affiliates.

[4]Spending for acquisitions is included in FDI but not in measures of investment spending in GNP accounting. Therefore, the shares in Chart 2 should be interpreted as indicating that FDI has been an increasingly important resource for investment but not necessarily a source of new physical capital.

Chart 1

Foreign Direct Investment in the United States

Billions of dollars

Cumulative Foreign Direct Investment Flows Billions of dollars		
	1977-84	1985-90
Total	133.8	261.9
Manufacturing	39.2	121.8

Total

Manufacturing

1977 78 79 80 81 82 83 84 85 86 87 88 89 90

Source: U.S. Department of Commerce.

Notes: Chart gives the book value of the stock of foreign direct investment in the United States. Data for 1990 do not include valuation adjustments. Manufacturing data do not include estimates of Japanese investment in auto plants. Such investment is classified under wholesale trade in the official data.

share of sales by foreign-owned firms in overall sales in manufacturing. Paralleling the increasing importance of foreign-owned firms in investment is the growth in their share of total manufacturing sales and assets to 11 percent and 14 percent, respectively, in 1988 (the latest year for which affiliate operating data are available). Over time, therefore, the Expansion and modernization of affiliate production capacity through investments and the transfer of foreign parents' competitive strengths should help to improve the performance of these affiliates.

A second important feature governing the influence of FDI flows on the U.S. trade balance is that investment occurred in nontraded goods industries as well as heavily traded goods industries. A total of $66.5 billion of foreign-controlled assets, or roughly 25 percent of all foreign-controlled manufacturing assets in 1988, were in three largely nontraded manufacturing industries: stone, clay, and glass; printing and publishing; and processed food products (Table 1). The expanded presence of foreign-owned firms in generally nontraded manufacturing industries implies only an indirect link

between FDI and current trade flows. If foreign ownership in these industries results in competitiveness gains for U.S. affiliates, however, certain segments of these currently nontraded industries could see an expansion of exports. Still, FDI in these nontraded manufacturing industries is not likely to result in a sizable short-term trade balance improvement.

A third feature of FDI in manufacturing is that some major source countries of FDI are not among the principal U.S. trading partners. The two largest foreign investors in U.S. manufacturing during the 1980s, for example, were the United Kingdom and the Netherlands (Table 2). Conversely, the largest U.S. trading partner, Canada, is not a major source of investment. The growth of FDI, therefore, is not likely to be followed by any large-scale substitution of domestically produced goods for imports from the countries acquiring control of U.S. manufacturing assets. Rather, any import displacement effects would probably be spread across a broader group of suppliers.
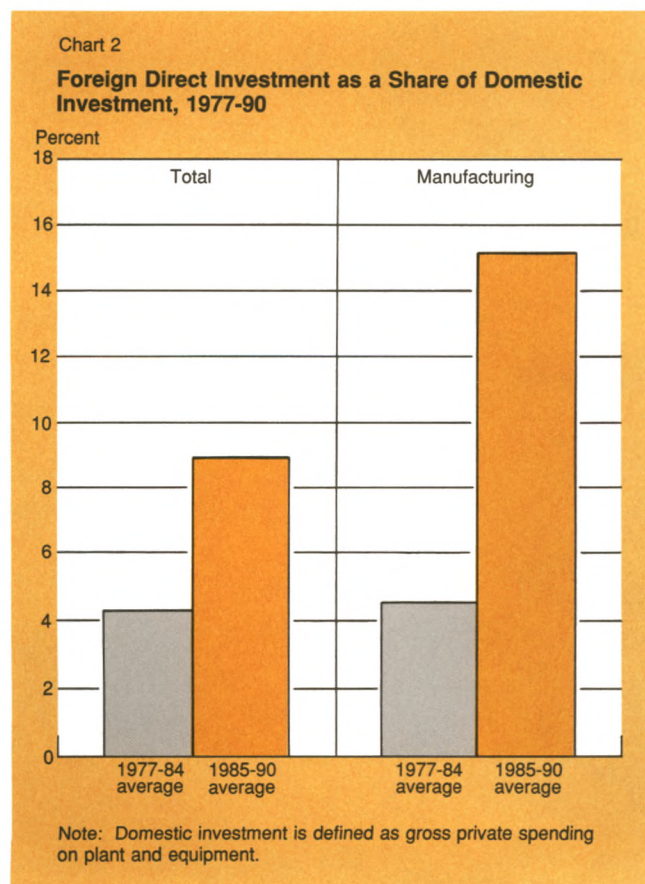
Among the major investors, only the Japanese depart from the patterns of foreign investment just described. Most Japanese investments have been in traded goods industries characterized by relatively large U.S.-Japan bilateral imbalances. Japanese investors, despite their relatively small share of control of U.S. manufacturing assets, control significant shares of the assets of several traded goods industries, including steel, electrical and nonelectrical machinery, and transportation equipment. Japan's investments suggest a significantly greater immediate link to U.S. trade balance adjustment than do the investments of other major FDI source countries.

On the whole, however, the major features of the rapid growth of FDI in U.S. manufacturing in the second half of the 1980s imply that significant export expansion or import displacement will likely occur over the medium-to-long term. Because foreign investors have generally chosen to establish their presence in the U.S. market through acquisitions of existing U.S. firms, improved efficiency in the operation of these firms is likely to be the major source of improved international competitiveness. Furthermore, the variety of sources of FDI and the presence of FDI in several nontraded industries suggest that eventual trade balance improvement could well involve a relatively broad group of foreign suppliers and currently nontraded products.

Estimating the FDI-trade balance link
Analytical framework
FDI can improve the U.S. trade balance by enhancing the ability of U.S. firms to compete abroad and to meet import competition at home. Competitiveness gains resulting from foreign ownership stem from increased

Chart 2

Foreign Direct Investment as a Share of Domestic Investment, 1977-90

Percent

Note: Domestic investment is defined as gross private spending on plant and equipment.

productive capacity, greater operating efficiency, and the transfer of competitive advantages from foreign producers to U.S. firms. These supply-side effects are over and above any direct effects on U.S. competitiveness arising from exchange rate movements on prices.

It is only over time, however, that new investments result in higher productivity and improved international competitiveness. In fact, in the initial period following a direct investment the trade balance typically worsens. Foreign-owned firms in the early stages of operation may look to the parent country as a source of capital

Table 1

Foreign-controlled Assets of U.S. Manufacturing Industries in 1980 and 1988

Industry	1988 Book Value of Assets under Foreign Control (Billions of Dollars)	Share of Industry Assets under Foreign Control (Percent)	
		1980	1988
All manufacturing	288.9	8.5	14.3
Stone, clay, and glass	21.1	13.4	41.1
Chemicals	80.9	18.4	29.3
Rubber and plastics	10.2	4.7	20.3
Steel and other primary metals	17.5	7.8	19.8
Fabricated metals	16.5	4.6	16.7
Electrical machinery	25.4	9.1	13.6
Printing and publishing	15.1	4.5	13.1
Food products	30.3	6.9	10.7
Machinery, nonelectrical	20.5	5.0	8.8
Paper	7.0	6.9	7.4
Textiles and apparel	4.1	4.7	6.8
Transportation equipment	17.3	4.4	5.9
Other industries	23.0	2.1	7.4

Sources: U.S. Department of Commerce and Federal Trade Commission.
Notes: All manufacturing data exclude petroleum and coal products. Data on the transportation equipment industry include an estimate of those assets of Japanese automobile producers that are classified under wholesale trade in the official data.

Table 2

Country Sources of Growth in Foreign Direct Investment, 1986-89

Country	All Industries		Manufacturing Industries	
	Value (Billions of Dollars)	Share of Total (Percent)	Value (Billions of Dollars)	Share of Total (Percent)
United Kingdom	72.2	33.3	40.0	39.1
Japan	50.0	23.8	14.7	14.4
Netherlands	23.4	11.1	11.2	11.0
West Germany	13.4	6.4	9.3	9.1
France	9.7	4.6	8.2	8.0
Canada	9.6	4.6	7.5	7.3
Rest of world	31.7	15.1	11.3	11.1

Source: U.S. Department of Commerce.

equipment and supplies, thus increasing imports. The amount of actual production that takes place locally, known as "local content" or "local value added," may initially be relatively small. The trade balance improves over time to the extent that the foreign-owned firms switch to local suppliers of parts and components, manufacture products that displace imports, and begin to export their products. The dissemination of the technological or managerial advantages of the foreign-owned firm to domestically owned firms may also improve the competitiveness of the entire industry and result in further long-term improvements in the trade balance.

The changing impact of FDI on the trade balance over time complicates the analysis of its aggregate trade balance effect. Moreover, the timing of the process by which FDI affects trade can vary with the nature of the industry and the method by which the foreign firm entered the U.S. market. For example, the initial adverse effect of FDI on an industry's trade balance is likely to be less important, although not entirely absent, when FDI takes the form of acquiring existing firms.

The following analysis of FDI uses a statistical model of aggregate merchandise exports and imports to estimate the potential medium- to long-term effects of supply-side changes on the trade balance. The analysis then turns to case studies of four manufacturing industries—automobiles, steel, electronic equipment, and chemicals. The case studies clarify the timing and process by which FDI affects trade performance across sectors. They are also instrumental in gauging FDI's impact on U.S. imports because they capture some effects masked by import restrictions in the aggregate statistical model. For the automobile industry in particular, industry and firm data allow a quantification of both the initial increases in imports and the longer run effects on import displacement and export expansion.

Aggregate trade balance estimates

In conventional trade models, changes in aggregate merchandise export and import volumes are typically related to changes in exchange rates, relative prices, and economic growth rates. Here the conventional model is expanded to include a measure of the impact of growth in foreign ownership of the U.S. manufacturing capital stock on trade patterns.[5] (See box for the details of the estimation procedure.) The specific variable entered into the model is the share of the capital stock in the U.S. manufacturing sector that is foreign owned. This share averaged only 1.5 percent during the

[5] A discussion of trade models and the use of a measure of U.S. industries' relative productive capacity to explain trade patterns can be found in William Helkie and Peter Hooper, "An Empirical Analysis of the External Deficit, 1980-1986," in Ralph Bryant, Gerald Holtham, and Peter Hooper, eds., *External Deficits and the Dollar* (Washington, D.C.: Brookings Institution, 1988).

1960s and 1970s but increased relatively rapidly during the 1980s. The growth in FDI since the mid-1980s increased the foreign-owned share of the manufacturing capital stock from about 4 percent in 1984 to more than 8 percent in 1990.

Effects on exports

Regression results show that U.S. exports expand in a statistically significant manner in response to increased foreign ownership of U.S. manufacturing firms. The response is estimated to occur on average two years after an initial investment. This effect is over and above the effects of exchange rates, relative prices, and foreign economic growth rates, factors that typically have a much more immediate impact on trade patterns. The deferred nature of the impact represents the time it takes for an increase in FDI to work through competitiveness channels to raise exports.

The model estimates suggest that the relatively large annual increases in FDI during the latter half of the 1980s are associated with an increase in the value of U.S. exports of roughly $20 billion over the longer term. That is, by 1992 the nominal value of U.S. exports will be roughly $20 billion higher than would otherwise have been expected because of the increased foreign ownership of U.S. manufacturing firms during this period. Increases in export volume account for over four-fifths of the projected increase in the nominal value of exports.

This potential $20 billion increase in exports arising from FDI would represent roughly a 5 percent increase over the 1990 level of merchandise exports. But the estimated longer term influence of the recent growth in FDI on exports might not perfectly measure the potential long-run expansion of exports for two reasons. First, limited past experience with FDI of this magnitude means there is little evidence on which to judge its effects on competitiveness. For example, exports might increase at a pace different from what the model predicts because the aggregate trade analysis does not measure the extent to which FDI will change the composition of exports. In particular, the model is not suited for estimating how extensively exports from traditionally nontraded goods industries are likely to grow. Second, the model does not use direct measures of productivity or other competitiveness gains associated with FDI but attributes the various changes in industry trade performance to the share of foreign ownership exclusively.

Effects on imports

The regression results indicate no significant reduction in imports arising from the growing foreign ownership of the U.S. manufacturing capital stock, even several years after the investment took place. In fact, the

results suggest that the initial increase in imports that is often observed following an increase in FDI is still not offset three years following the investment inflow.

A consideration of the industries that have been the largest recipients of FDI may explain this finding. Two of the most heavily traded manufacturing sectors that have received significant investment from abroad, automobiles and steel, have been protected from import competition during much of the past decade. Past experience with FDI, therefore, will not capture the potential for import reductions in these industries in the future. For example, quotas effectively restrained imports of cars from Japan in the early and mid-1980s, and steel quotas bound several major suppliers in the mid-1980s, including Japan and the countries in the European Economic Community. Further displacement of imports was unlikely to follow from increases of FDI in these industries. Nevertheless, because import restraints are no longer binding in these two industries, future reductions in imports due to FDI could be significant.

Trade balance effects of FDI in selected industries

The aggregate statistical analysis provides only limited insight into the likely long-term trade balance effects of

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Box: Estimating the Trade Balance Effects of Foreign Direct Investment

Conventional trade models relate U.S. export and import volumes to exchange rates, relative prices, and measures of economic activity. Extensions of conventional trade models include various measures of the U.S. capital stock to capture the influence of long-run supply-side changes in U.S. competitiveness on trade flows. The trade model estimated in this article includes measures of both the overall U.S. capital stock and the for-

Explanatory Variable	U.S. Exports	U.S. Imports
Intercept	−0.6 (−0.2)	−10.1 (−6.2)
Foreign economic activity†	1.2 (1.6)	—
U.S. domestic demand	—	2.4 (5.6)
U.S./foreign prices‡	−.77	.64
U.S. capital stock	.06 (4.5)	.03 (0.21)
FDI		
Two-year lag	.21 (2.6)	.33 (2.7)
Three-year lag	—	−.15 (−0.9)
Trend	−0.2 (−3.9)	—
Statistics		
R̄²	.98	.99
Durbin-Watson	1.7	2.3

†Trade-weighted average of domestic demand in the major six foreign economies.

‡Figure is the sum of current and one-year lagged coefficients in the export equation, and current, one-, and two-year lagged coefficients in the import equation.

eign-owned share of the U.S. capital stock in the manufacturing sector to capture the influence of these separate sources of change in U.S. competitiveness on U.S. trade flows. The estimated equation uses relatively long lags of the FDI measure to allow sufficient time for the effects of FDI on trade to be observed and to avoid capturing the short-run adverse effects on trade flows that often follow an increase in FDI.

The model was estimated using annual data for the period 1967–89. The regression coefficients are presented in the table (t-statistics in parentheses).

The economic activity, relative price, and FDI variables were entered in the equation in logarithmic form, and hence their coefficients could be interpreted as elasticities. The U.S. capital stock variable was entered as an index. The export equation was corrected for serial correlation.

Both the U.S. capital stock and FDI variables were estimated to have had statistically significant positive effects on exports, but neither had a statistically significant effect on imports. The text estimate of a $20 billion potential future increase in exports due to FDI was computed by applying the estimated elasticity of real exports to FDI of .21 to the growth in the share of foreign ownership of the U.S. manufacturing capital stock during the latter half of the 1980s.§ This procedure yielded an estimated total increase in exports of roughly $18 billion. Nominal export values were then computed by assuming that export prices grew at 2.0 percent annually, the average annual growth rate of export prices between 1985 and 1990.

§The actual calculation assumed that .21 was an arc elasticity rather than a point elasticity in order to apply it to the large percentage change in FDI.

FDI in the latter half of the 1980s. The statistical analysis is hampered by the relatively brief time that has elapsed since these investments were undertaken and by import restraints in some key industries. Additional information about the process and timing of the effects of FDI on trade can be gained from case studies of four industries: automobiles, steel, electronics, and chemicals. These industries have had sizable shares of investment from the major FDI source countries and, with the exception of automobiles, all have had a relatively long experience with FDI. These industries account for one-half of all foreign-owned assets in the U.S. manufacturing sector. In 1990, moreover, these industries accounted for over one-half of all U.S. non-oil imports and one-third of nonagricultural exports. Deficits with the major source countries in these industries equaled roughly one-half of the U.S. merchandise trade deficit (Table 3). Estimates of the effects of FDI on exports and imports in these industries, therefore, provide a basis for extrapolating the aggregate effects of FDI on the U.S. trade balance.

Automobiles

Japanese investments in the U.S. automobile industry provide perhaps the strongest potential link between

FDI and U.S. trade.[6] Currently, all major Japanese automobile producers are operating passenger car assembly facilities, or "transplants," in the United States. Data on unit sales of passenger cars show that Japanese automobile transplants have steadily increased their sales in the U.S. market from roughly 50,000 in 1984 to 680,000 in 1989 and more than 1 million in 1990 (Chart 3). U.S. trade restraints have been a prime factor behind the inflow of Japanese FDI. Increased production by Japanese transplants in the United States between 1983 and 1985 coincided with the binding restraints in effect on exports of Japanese cars.[7] Since 1986, however, restraints on exports have not as a whole been binding, reflecting both dollar depreciation and, more recently, the slowdown in the overall U.S. auto market.

The trade balance effects of the transplants can be studied in two stages. In the first stage, the key ques-

[6]Germany, the other major foreign investor in the U.S. automobile industry, has ceased all automobile production in the United States.

[7]Between April 1981 and March 1984, annual exports of passenger cars from Japan were limited to 1.68 million units; and from April 1984 on, to 1.84 million units. The limit was raised to 2.3 million in 1986 and remains at that level.

Table 3

U.S. Trade with Principal Foreign Investors in Selected Manufacturing Industries, 1990

Industry	Total 1990 Imports (Billions of Dollars)	Principal Investors	Imports from Principal Investors, 1990 (Billions of Dollars)	Industry Bilateral Trade Balance, 1990 (Billions of Dollars)
Automobiles	87.2	Japan	32.2	− 30.7
Steel and other primary metals	19.6	Japan	1.5	+ 1.2
		Canada	6.0	− 2.2
Chemicals	14.2	United Kingdom	1.1	− 0.1
		West Germany	1.9	− 0.9
		Canada	3.3	+ 1.1
Electronic equipment	72.5	United Kingdom	1.2	+ 3.4
		Canada	6.1	+ 4.0
		Japan	26.3	− 19.9
Total	193.5		79.6	− 43.0
Share of total non-oil imports, 1990 (percent)	44.6		18.3	
Share of merchandise trade deficit, 1990 (percent)				42.6

Source: U.S. Department of Commerce.

tion is the extent to which the transplants import capital equipment and supplies. The share of automobile inputs produced by U.S. suppliers, or the domestic sourcing of Japanese transplants, is currently about 50 percent, implying that half the parts and materials used in each automobile in a Japanese assembly plant in the United States are imported. This relatively high import content, coupled with the imports of capital equipment and supplies used to establish and outfit the plants, is estimated to have raised U.S. imports by roughly $2.5 billion in 1989. Domestic sourcing in Japanese-owned automobile plants is, however, expected to increase to roughly 75 percent by 1993, achieving a level slightly below the projected 83 percent domestic sourcing of U.S. producers for the same year.

Estimating the longer run trade balance effects entails considering not only the extent of increased domestic sourcing, but also the degree to which cars produced by the transplants will displace imports and the value of transplant exports. The displacement rate is defined as the reduction in the volume of imported cars associated with an increase in production by Japanese transplants. An estimate of this displacement rate can be derived in the following way: Between 1983 and 1989, Japanese automobile transplants increased their share of the U.S. domestic market from 0.5 percent to 6.8 percent. Comparing this 6.3 percent increase in the market share of Japan's transplants with the roughly 1.5 percent to 2 percent decline in the

market share of imports from Japan over the same period suggests a rough displacement rate of Japanese imports by transplant production in the U.S. market of 30 percent.[8] That is, for each 100 cars produced in Japanese-owned factories in the United States, 30 fewer cars will be imported from Japan. Even this relatively low displacement rate may be an overestimate because part of the recent import decline results from the falling value of the dollar over this period.[9]

As to export prospects, by 1993 Japanese transplants are expected to meet their announced plans to export cars both back to Japan and to other destinations. Actual exports from Japanese transplants in 1989 totaled about 18,000, the majority going to Japan but a significant number going to Taiwan. By 1993, exports from Japanese auto transplants are expected to increase to about 150,000.

Combining these major components of Japanese auto transplant operations allows a rough calculation of the short- and longer term bilateral trade balance effects of Japanese direct investment in the U.S. automobile industry (Table 4). If we assume that Japanese auto plants are producing at their announced capacity levels in 1993, production of passenger cars will increase from 680,642 in 1989 to 1.6 million in 1993. If prices of the cars produced in Japanese transplants increase from their 1989 level of $11,500 at 6 percent annually, the 1985-89 average annual increase in new car prices, their price will rise to $14,560 in 1993, and the current dollar value of this production will increase from $7.8 billion in 1989 to $23.3 billion in 1993. Auto exports are also expected to increase from their 1989 estimated value of $0.2 billion to $2.2 billion. Domestic sourcing by Japanese auto transplants is expected to increase from the current rate of 50 percent to 75 percent by 1993. Imports of capital equipment by Japanese transplants from Japan are assumed to be negligible in 1993.

[8]This rate is similar to a Nomura Research Institute estimate that roughly 25 percent of the difference between the forecasted and actual 1990 import market share was attributable to the presence of transplants (Nomura Research Institute, *Quarterly Review*, May 1990).

[9]Industry analyses suggest that over the next few years the impact of Japanese automobile investment on the trade balance may become smaller. By 1993 transplants will have been producing for the compact car segment of the U.S. automobile market for a decade. Imports from Japan, which in 1983 were virtually all in the compact car segment (including mini-subcompacts and subcompacts) will increasingly be classified in the midsize and luxury car segments of the market. Several of these models are priced in the $25,000 to 30,000 range, more than double the current average price of about $11,500 for the most popular transplant models. Although about 87 percent of Japanese imports are still classified as compacts, this compositional shift has reduced the substitutability of imports with transplants and increased the average price and hence the nominal value of future imports relative to current imports.

Chart 3

New Car Sales in the United States

Sources: Ward's Automotive Reports and Automotive Yearbook.

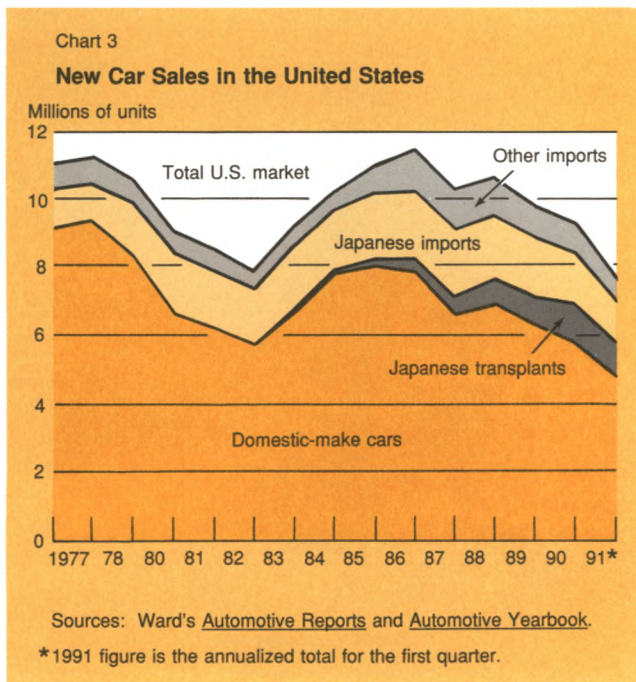*1991 figure is the annualized total for the first quarter.

Table 4 brings together the current and projected transplant operations data to produce an estimate of the initial and longer run trade balance effects. In 1989, higher imports of capital equipment and parts for transplant operations worsen the U.S.-Japanese bilateral trade balance by $2.6 billion, offsetting the $2.5 billion improvement in the trade balance resulting from the reduction in auto imports. By 1993, the trade balance effects associated with the $23.3 billion automobile production in Japanese transplants turn positive. Since the longer run effects result primarily from the displacement of imports from Japan, the magnitude of these effects depends critically on the extent to which transplant output is assumed to replace imports. Maintaining the assumption of a relatively low import displacement rate of 30 percent results in an estimated trade balance improvement of $5.4 billion. Auto exports rise by $2.2 billion, auto imports fall by $7.0 billion, and imports of parts and components equal $3.8 billion. Alternatively, if the extreme assumption of a 100 percent displace-

ment rate is made, a much larger positive effect, an improvement in the trade balance of $21.7 billion, is realized. Of course, a 100 percent displacement of imports is highly unlikely.

In sum, the presence of Japanese transplants in the United States will reduce the U.S.-Japan trade deficit over the medium term as Japanese automobile companies increasingly serve the U.S. market through their U.S. affiliates. Nevertheless, the size of the improvement is likely to be only about $5 billion if the import displacement rate remains at its estimated 1989 level.

Steel
FDI in the U.S. steel industry during the 1980s accompanied the downsizing and modernizing of that sector. Between 1980 and 1989, the value of assets in the U.S. steel industry fell by one-third, and the work force was cut in half. FDI during this period became an important feature of the restructuring of the U.S. steel industry and, in fact, helped maintain the viability of several U.S.

Table 4

Estimated Trade Balance Impact of Japanese Auto Transplants
(Billions of Dollars)

	Initial Effects (Billions of Dollars)	
	1989 (Actual)	1993 (Projected)
Capital equipment imports†	−0.5	0.0
Parts/components imports‡	−2.1	−3.8
Total	−2.6	−3.8

	Longer Run Effects (Billions of Dollars)		
	1989 (Actual)	1993 (Projected)	
Assumed import displacement rate	30	30	100
Imports displaced	2.3	7.0	23.3
Exports	0.2	2.2	2.2
Total	2.5	9.2	25.5
Total trade balance effects	−0.1	5.4	21.7

Memo: Assumptions underlying Table 4 calculations		
	1989 (Actual)	1993 (Projected)
1. Auto production: number of cars	680,642	1,600,000
2. Auto exports: number of cars§	18,000	150,000
3. Auto prices: average price of Japanese transplants sold domestically and exported‖	$11,500	$14,560
4. Yen/dollar exchange rate	138	138

†Value of capital equipment based on estimated total capital investment of $5 billion during the 1980s.
‡Value of imported parts/components based on estimated share of parts/components supplied locally.
§Taken from announced export plans.
‖Prices of cars produced in transplants in 1989 were computed as a weighted average of the price of the most popular 1989 models of the four Japanese transplants: Honda Civic and Accord, Nissan Sentra, Mazda MX6, and Toyota Corolla. Shares of total production were used as weights. Prices of 1993 models were estimated by inflating the 1989 prices by 6.2 percent annually, the average annual inflation rate in domestically built cars between 1985 and 1989.

steel producers.

Significant increases in investment in the U.S. steel industry came from Japan and Canada, particularly in the early and mid-1980s. These investments largely took the form of joint ventures with U.S. steel producers rather than the building of new steelmaking capacity. Much of Japan's investment in the U.S. steel industry was undertaken to supply inputs to Japanese auto transplants. By 1989 all major U.S. steel producers except Bethlehem Steel had formed joint ventures with Japanese steel producers. Total FDI in the U.S. steel industry during the 1980s increased the foreign-owned share of U.S. steel assets from 13 percent in 1980 to more than 34 percent in 1988.[10]

Imports of steel were restrained throughout most of the 1980s, particularly following the negotiation of Voluntary Export Restraints in 1984. These restraints limited the import market share in volume terms of several important steel industry products to roughly 20 percent.[11] Interestingly, European Community steel firms, although facing binding restrictions on their exports, did not establish or acquire significant new steel production capacity in the United States during the 1980s. By contrast, acquisitions by Japanese steel firms in recent years have made Japan the largest single foreign investor in the U.S. steel industry, with assets valued over $5 billion. This investment in the U.S. steel industry was undertaken at the same time that Japan was filling only about 75 percent of its allowable steel import limit.

Data are not available to analyze the impact of FDI in the steel industry thoroughly. In particular, no information is available concerning the extent of domestic and foreign sourcing of components or the value of imports of capital equipment. However, the bulk of FDI in steel came in the early and mid-1980s, suggesting that the longer term effects of FDI on import displacement and increased export sales are the relevant considerations for this study.

Affiliate operating data, available only for the primary metals market and with a relatively long time lag, show that since 1984 the transplant share of total production has fluctuated between 15 and 17 percent, while the transplant share of new capital spending has been in the range of only 8 percent to 12 percent (Chart 4). These data suggest that the transplants have not been major catalysts in the upgrading of investment and

hence have not yet been a source of significantly improved export prospects for the industry.

Significant reductions in steel imports did not coincide with the growth of foreign investment in the U.S. steel industry during the 1980s. Import restraints were already limiting the ability of foreign firms to penetrate the U.S. market, keeping the overall share of nominal steel imports in the U.S. market at roughly 16 percent. Data describing the foreign share of the U.S. domestic primary metals market show that import market shares did not significantly decline as affiliate market share grew in the early 1980s. Since the mid-1980s, the mar-

Chart 4

Foreign Share of the U.S. Primary Metals Industry

Shares of Sales and Capital Spending by Foreign-owned Firms
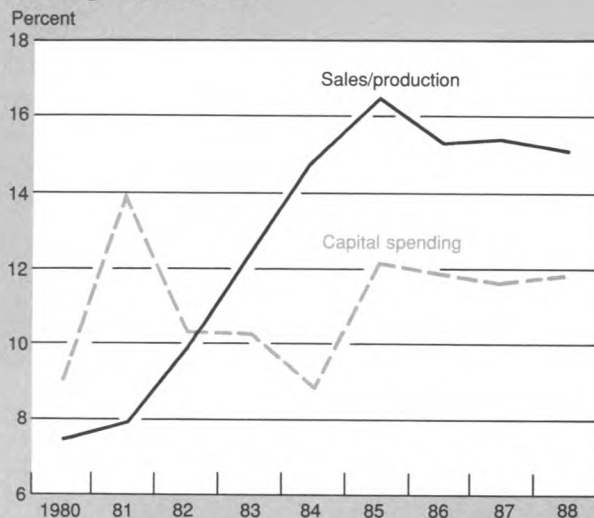
Notes: Sales are total sales of foreign-owned firms as share of total domestic production; capital spending is share of total spending for new plant and equipment in the industry.

Foreign Share of Domestic Primary Metals Sales

	1980	1985	1988	1989	1990
Imports	13.0	16.2	16.1	16.2	15.1
Affiliate sales	6.5	13.4	12.7	n.a.	n.a.
Foreign share	19.5	29.6	28.8	n.a.	n.a.

Note: Foreign share is the percent of total domestic sales accounted for by imports and affiliates.

Source: U.S. Department of Commerce.

[10]Major foreign equity investments in the U.S. steel industry during the 1980s are listed in United States International Trade Commission, "Annual Survey Concerning Competitive Conditions in the Steel Industry and Industry Efforts to Modernize and Adjust," Publication no. 2226, October 1989.

[11]The industry had been receiving protection from import competition in various forms since the 1960s.

ket shares of imports and affiliates have both been relatively stable.

The impact of FDI from Japan, however, may be an exception to this general conclusion. A comparison of data for 1980 and 1988 reveals that a declining share of Japanese imports in the U.S. primary metals market has been associated with a higher market share for Japanese affiliates. A simple calculation can provide a rough estimate of the effect of Japanese acquisitions of U.S. steelmaking capacity on the U.S.-Japan trade balance in steel. Suppose that Japan's import market share had risen to fill its quota level by 1988, achieving a growth rate slightly less than that for imports of all Japanese manufactured goods. On this assumption, imports from Japan would have taken a larger share of the U.S. market, and the affiliate share would have been correspondingly lower. This higher import market share would have boosted imports of primary metals from Japan roughly $1 billion in 1988.

How the presence of foreign-owned firms will affect long-run prospects for continued improvement in the trade balance in the U.S. steel industry depends on the ability of the U.S. affiliates to expand their exports and further displace imports. Data on the share of U.S. primary metals affiliates in primary metals industry domestic sales and capital investment suggest that the affiliates will maintain their current share of industry exports but will probably not expand exports substantially. Long-run trade balance improvement in the U.S. steel industry, therefore, will result primarily from further displacement of imports by sales from U.S. affiliates.

The data presented on the trends in affiliate sales and import penetration of the U.S. primary metals market do not indicate that FDI is likely to be associated with significant import reduction. Nevertheless, that Japanese-owned steel plants are major suppliers of inputs to Japanese-owned auto transplants suggests some potential for future import reduction in steel. A rough estimate of the value of this future steel import reduction due to FDI can be derived from an estimate of the future growth in sales of primary metals affiliates in the U.S. market. In 1988, U.S. primary metals affiliate sales totaled $21 billion, having grown at an annual rate of roughly 4 percent since 1984. Continued annual sales growth at this rate through 1993 would raise total affiliate sales $5 billion to a new level of $26 billion. Affiliates of Japanese parents currently account for about one-fourth of sales of primary metals in the U.S. market. If their future share of all affiliate sales remained roughly the same, these Japanese affiliates would account for about $1 billion of additional sales. And if these affiliate sales fully displaced U.S. imports of primary metals, the steel industry trade balance would improve by the same magnitude.

Electronic equipment

The U.S. electronic equipment industry has had a relatively long experience with FDI. One segment of the industry, color televisions, which received protection from Japanese (and later Taiwanese and South Korean) imports from 1977 to the early 1980s in the form of negotiated Orderly Marketing Agreements, saw the start-up of seven Japanese-owned plants during the 1970s. In fact, by 1980 about 10 percent of all U.S. electronics industry assets were foreign owned, and by 1988 FDI increased this share to 13 percent.

Operating data on U.S. electronic equipment affiliates suggest that the growth in sales of these affiliates has not led to significant increases in electronic equipment exports. While foreign-owned firms accounted for roughly 11 percent of domestic sales in the industry in 1988, the foreign-owned share of exports was somewhat less (Chart 5).[12] Operations data also show that the affiliates have not been a particularly strong source of new capital spending in the industry. Despite the affiliates' competitiveness in the domestic market over the 1980s, their effect on industry performance and export expansion has not been substantial to date.

The electronics industry is the only one of the four industries under analysis in which imports, both in nominal terms and as a share of the domestic U.S. market, have grown rapidly throughout the entire 1980s. The import share of the domestic U.S. market for electronics grew at about the same rate as the import share of the U.S. manufacturing sector as a whole. Although the U.S. domestic market for electronic equipment doubled between 1980 and 1988, imports more than tripled over the same period. Moreover, sales of the U.S. affiliates of foreign firms grew almost two and a half times.

The performance of Japanese affiliates in the U.S. market illustrates the limited impact of FDI on electronic equipment imports. The share of the U.S. electronic equipment market held by U.S. affiliates of Japanese firms increased from 3.8 percent in 1980 to 7.5 percent in 1988. Over the same period, the market share of imports of electronic equipment from Japan doubled, growing at roughly the same rate as Japan's import market share in all manufactured goods. Consequently, the growth of sales from U.S. electronic equipment affiliates of Japanese firms appears to have had little impact on the growth of imports of electronic equipment from Japan.

Long-run prospects for trade balance improvement in the U.S. electronic equipment industry as a result of FDI appear limited. In 1988, exports from electronic equipment affiliates were roughly $2.5 billion, only

[12]It should be noted that the export share of electronic equipment affiliates did increase relative to the affiliate share of industry sales in 1988.

slightly above the $2.0 billion recorded in 1984. Projecting this rate of growth through 1993 suggests an export expansion of less than $1.0 billion. The affiliate operating data on capital investment provide little basis for more optimistic assessments of export growth in the electronic equipment industry.

The growth in imports of electronic equipment shows no signs of abating over the next several years. A significant share of the foreign-owned elctronics facilities are assembly operations that have relatively low local content. Imports of foreign-produced parts and supplies, therefore, increase in proportion to domestic production. Productivity advances and competitive cost structures abroad may further contribute to import expansion by enabling developing economies to expand their exports into a variety of electronics product lines. Moreover, outsourcing by U.S. electronics producers to Asian and Latin American countries will also lead to continued import expansion. The presence of foreign-owned electronic equipment firms in the U.S. market, therefore, appears unlikely to reverse the strong growth in imports of electronic equipment observed in the 1980s.

Chemicals

The U.S. chemicals industry has had a longer and more extensive experience with foreign ownership than most U.S. manufacturing industries. In 1980 over 16 percent of the assets of the industry were foreign-controlled. This total increased to almost 30 percent in 1981, following the acquisition of about 20 percent of the assets of DuPont by Canadian investors.[13] Unlike the other industries in this analysis, the chemicals industry has always been a strong exporter, has generated a trade surplus, and has not faced significant trade restrictions. The major foreign investors in the U.S. chemicals industry include Canada, the United Kingdom, and West Germany, and virtually all FDI has taken the form of acquisitions of existing U.S. firms.

Data on the shares of U.S. affiliates of foreign chemicals firms in industry sales, capital spending, and exports suggest that the foreign presence may be increasingly significant in the long-run trade performance of the industry (Chart 6). The affiliate share of U.S. chemicals industry sales was relatively stable throughout the 1980s. However, both the affiliates' share of U.S. chemicals industry exports and their share of capital spending in the U.S. chemicals industry have been increasing relative to their share of sales. This finding suggests that the U.S. affiliates of foreign chemicals firms have become increasingly important in the overall trade competitiveness of the U.S. chemicals industry. The increase in the affiliate share of exports relative to their share of sales also suggests that U.S. chemicals affiliates are more oriented toward exporting their products than are domestic U.S. chemicals firms.

The relatively strong export orientation of chemicals affiliates is reflected in their relatively weaker performance in the U.S. market. The total foreign share of domestic U.S. chemicals sales, defined as the sum of import and affiliate shares, grew by only 3.4 percent between 1981 and 1988. This growth was due almost

Chart 5
Foreign Share of the U.S. Electronics Industry

Shares of Sales, Capital Spending, and Exports by Foreign-owned Firms
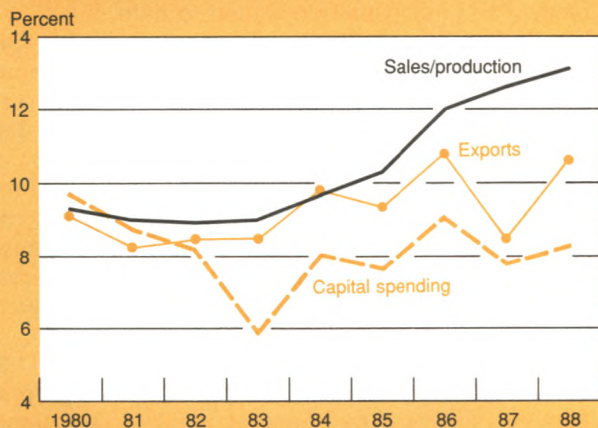
Notes: Sales are total sales of foreign-owned firms as share of total domestic production; capital spending is share of total spending for new plant and equipment in the industry; exports are shares of industry totals.

Foreign Share of Domestic Electronics Sales

	1980	1985	1988	1989	1990
Imports	12.1	17.7	20.7	21.3	25.8
Affiliate sales	8.2	8.6	10.6	n.a.	n.a.
Foreign share	20.3	26.3	31.3	n.a.	n.a.

Note: Foreign share is the percent of total domestic sales accounted for by imports and affiliates.

Source: U.S. Department of Commerce.

[13]The motives behind this acquisition seem to differ from those driving most foreign investment. The Canadian investors owned shares of Conoco, an oil company, and became owners of DuPont when the two companies merged. The influence of DuPont cannot be analyzed separately from that of other chemicals affiliates.

entirely to an increase in import market share. Consequently, FDI in the U.S. chemicals industry, in contrast to FDI in the auto and steel industries, appears not to have had a significant displacement effect on U.S. chemicals imports.

In the long run, a continued expansion of exports by U.S. chemicals industry affiliates should improve the U.S. chemicals industry trade balance. After increasing at an annual rate of 11 percent since 1984, affiliate exports reached $8.5 billion in 1988. Projecting this rate of increase through 1993 suggests that the exports of chemicals industry affiliates would rise an additional $8 billion to more than $16 billion. Only part of this estimated increase, however, represents an increase in exports beyond what would have been expected on the basis of the current share of affiliates in chemicals

industry exports. Nevertheless, some fraction of this increase, perhaps $4 billion to $5 billion, can be attributed to the growing importance of chemicals industry affiliates in U.S. exports of chemicals.

Summary of estimated trade balance effects

The standard trade model analysis of the rapid buildup of FDI in the latter half of the 1980s suggests an aggregate long-run trade balance improvement on the order of $20 billion. This improvement is projected to result entirely from an expansion of exports. The statistical analysis indicates that the FDI buildup will have no impact on aggregate import levels.

However, several problems, most notably import restrictions, complicate the aggregate analysis. An analysis of FDI in four individual industries provides a more detailed understanding of the process by which FDI affects trade. Summing the trade balance effects estimated from the experiences of these four industries suggests a somewhat larger trade balance improvement.

The increase in exports predicted by the analysis of individual industries is somewhat smaller than that predicted by the aggregate statistical analysis. Exports in these four industries are estimated to expand by about $6 billion and are about equally divided between autos and chemicals. Since FDI in these four industries makes up about one-half of all FDI in manufacturing, a straightforward extrapolation of these industry estimates to all U.S. industries implies an expansion of U.S. exports of $12 billion, or twice the estimated industry effect. This estimated expansion of exports is about 60 percent of the increase in exports estimated in the aggregate analysis. Since neither method of estimating the export effect is without problems, a reasonable order of magnitude estimate of the long-run effect of
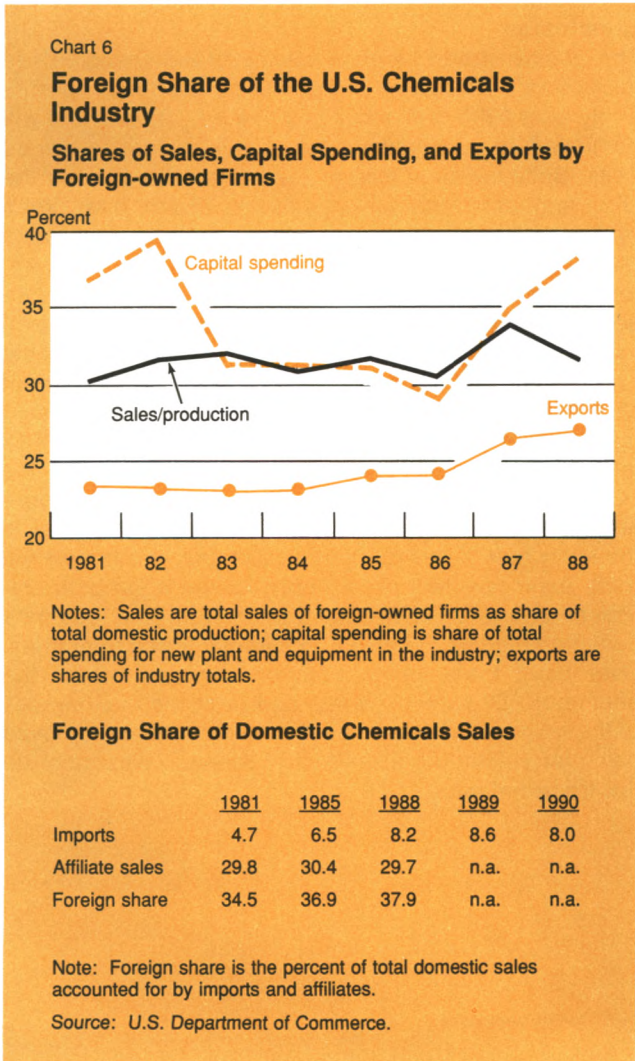
Chart 6

Foreign Share of the U.S. Chemicals Industry

Shares of Sales, Capital Spending, and Exports by Foreign-owned Firms

Notes: Sales are total sales of foreign-owned firms as share of total domestic production; capital spending is share of total spending for new plant and equipment in the industry; exports are shares of industry totals.

Foreign Share of Domestic Chemicals Sales

	1981	1985	1988	1989	1990
Imports	4.7	6.5	8.2	8.6	8.0
Affiliate sales	29.8	30.4	29.7	n.a.	n.a.
Foreign share	34.5	36.9	37.9	n.a.	n.a.

Note: Foreign share is the percent of total domestic sales accounted for by imports and affiliates.

Source: U.S. Department of Commerce.

Table 5

Long-Run Trade Balance Effects of Foreign Direct Investment

		(Billions of Dollars)
A.	Increase in exports (model results and industry extrapolation)	15
B.	Decrease in imports (industry extrapolation)	10
C.	Net trade balance effects (A + B)	25

Notes: The estimated increase in exports is an average of the results of the aggregate statistical analysis and the industry effects. The estimated decrease in imports is extrapolated from industry effects.

FDI on exports would seem to be $15 billion, the rough average of the estimated aggregate and industry level effects.

In contrast to the aggregate statistical analysis that showed imports to be unaffected by FDI, analysis of the four industries suggested that imports would be reduced in the long run by roughly $5 billion. The aggregate analysis finding that FDI had no significant effect on imports reflects, in part, limitations on the usefulness of the standard trade model in this context. In particular, imports in several industries that have been important for FDI have been restrained during the 1980s by quotas. These import restraints have been relatively significant factors in trade in automobiles and steel, the two industries in which the industry-level studies pointed to potential import reductions due to FDI. Therefore, an estimate of the aggregate effect of FDI on imports is based entirely on the industry-level effects. Because FDI in these four industries was roughly one-half of all FDI in manufacturing, a straight-forward extrapolation of these industry effects suggests that imports would be lower in the long run by roughly $10 billion, or twice the estimated industry impact.

Combining the estimated expansion of exports of $15 billion attributable to FDI with the estimated reduction in import levels of $10 billion yields a net long-run trade balance improvement of $25 billion (Table 5). That is, as a result of the FDI that occurred in the latter half of the 1980s, the long-run trade balance is estimated to be improved by $25 billion relative to what it otherwise would have been. This estimated net trade balance effect would have represented a substantial improvement in the 1990 merchandise trade deficit of roughly $100 billion. The full effects of FDI on trade flows, however, are of a long-run nature and will not be completely realized for several years.

The estimated aggregate trade balance reduction attributable to FDI cannot be distributed regionally to produce estimates of the bilateral trade balance effects arising from FDI. Nevertheless, the evidence presented here does cast doubt on suggestions by some analysts that FDI will halve the current U.S.-Japan bilateral deficit. In those industries likely to be sources of trade deficit reductions with Japan, automobiles and steel, a smaller overall trade balance reduction appears much

more likely. Significant bilateral effects attributable to FDI from other source countries, particularly the United Kingdom, are also likely to be small, because these investments are not clearly associated with the penetration of the U.S. market by U.K. imports.

The estimates of the potential trade balance effects of FDI in the U.S. manufacturing sector reported in this article are based on a study of the foreign investment that occurred in the latter half of the 1980s. To the extent that FDI in U.S. manufacturing industries is an ongoing process, however, foreign ownership of U.S. manufacturing firms will continue to expand into the 1990s. Although the relatively rapid rate of growth of FDI in the second half of the 1980s may not be repeated, additional FDI can be expected to result in further long-run improvements in the U.S. trade balance.

Conclusion

The positive trade balance effects of increased FDI in the U.S. manufacturing sector during the 1980s, particularly after 1985, will occur over the longer term and will be linked to competitiveness gains in foreign-owned firms. Because most foreign investors have entered the U.S. market by acquiring existing firms rather than transplanting production facilities, greater operating efficiency is likely to be the source of improved performance. Past experience with FDI, although limited, suggests that recent FDI inflows could lead to an improvement of roughly $25 billion in the U.S. trade balance.

This $25 billion net trade balance improvement should be interpreted as an order of magnitude estimate of the potential longer run effect of recent FDI inflows. The estimate is very uncertain because the U.S. manufacturing sector has had limited past experience with the sharp increases in FDI that occurred in the latter half of the 1980s. Furthermore, the longer run trade balance effect estimated from the aggregate statistical analysis differs somewhat from the estimate based on studies of individual manufacturing industries. Over time, these constraints on the analysis of the effects of FDI should be reduced, and the experiences of the manufacturing sector should provide an improved basis for estimating the effect of foreign investment on the trade balance.

Treasury and Federal Reserve Foreign Exchange Operations

February-April 1991

After setting new historical lows against the mark in mid-February, the dollar rebounded strongly during the February-April period to close up on balance by more than 15 percent against the mark and nearly 4 percent against the yen. The turnaround in the dollar was initially triggered by official intervention, but then was quickly reinforced both by optimism engendered by the swift conclusion of the Persian Gulf war and accompanying expectations of an early recovery of the U.S. economy from recession. The dollar's rise was particularly pronounced against the mark and certain other European currencies and occurred mainly during late February and March. In April, when the initial euphoria about U.S. economic prospects began to fade, the dollar lost upward momentum while retaining a generally firm tone.

Early February—continued dollar decline
The period opened with the dollar renewing a decline that had begun in late 1989. During the months just preceding the period, this decline had been temporarily interrupted, with market participants wary of selling dollars aggressively out of concern that war in the Persian Gulf might trigger large "safe-haven" flows into the dollar and push up the exchange rate. By early February, however, this possibility appeared remote. The dollar had not received lasting support from the outbreak of war in mid-January. With aerial bombing by the United States and its allies in Operation Desert Storm well underway, the likelihood that the conflict

A report presented by Sam Y. Cross, 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.

would widen to the point of generating new and substantial flows into dollars receded. At the same time, concern that the war might become prolonged and serve as a drag on the U.S. economy intensified. In that environment, the dollar became vulnerable to selling pressure because of the continued movement of interest rate differentials against the dollar and the more attractive investment opportunities available elsewhere. Market participants felt there was little official concern about exchange rate developments and saw little reason to expect the decline to end—even though the dollar appeared increasingly undervalued in terms of purchasing power.

On the last day of January, the Bundesbank had increased its official discount and Lombard rates in a move whose timing surprised many in the market. One day later, on February 1, as the period opened, the Federal Reserve discount rate was reduced 50 basis points to 6 percent and the fed funds rate also moved down 50 basis points. The juxtaposition of the moves in the two countries served to reinforce the prevailing market expectation that the dollar was likely to continue to decline and encouraged those who had dollars to buy to postpone their purchases, and the dollar reached a low of DM 1.4645 against the mark.

Beginning on the next business day, February 4, the U.S. monetary authorities intervened with the aim of reintroducing a sense of two-way risk for the dollar. On that day, the U.S. authorities purchased $100 million against marks and were joined in concerted intervention by a large number of foreign central banks. This intervention, coming after a considerable absence, initially surprised the market and was taken as a show of

concern, prompting the dollar to recover somewhat. Over the days that followed, the U.S. monetary authorities continued to operate in the market to dispel the impression that the dollar would continue to decline. In the seven days between February 4 and February 12, the U.S. authorities purchased a total of $1,389 million against marks, operating generally in concert with other monetary authorities.
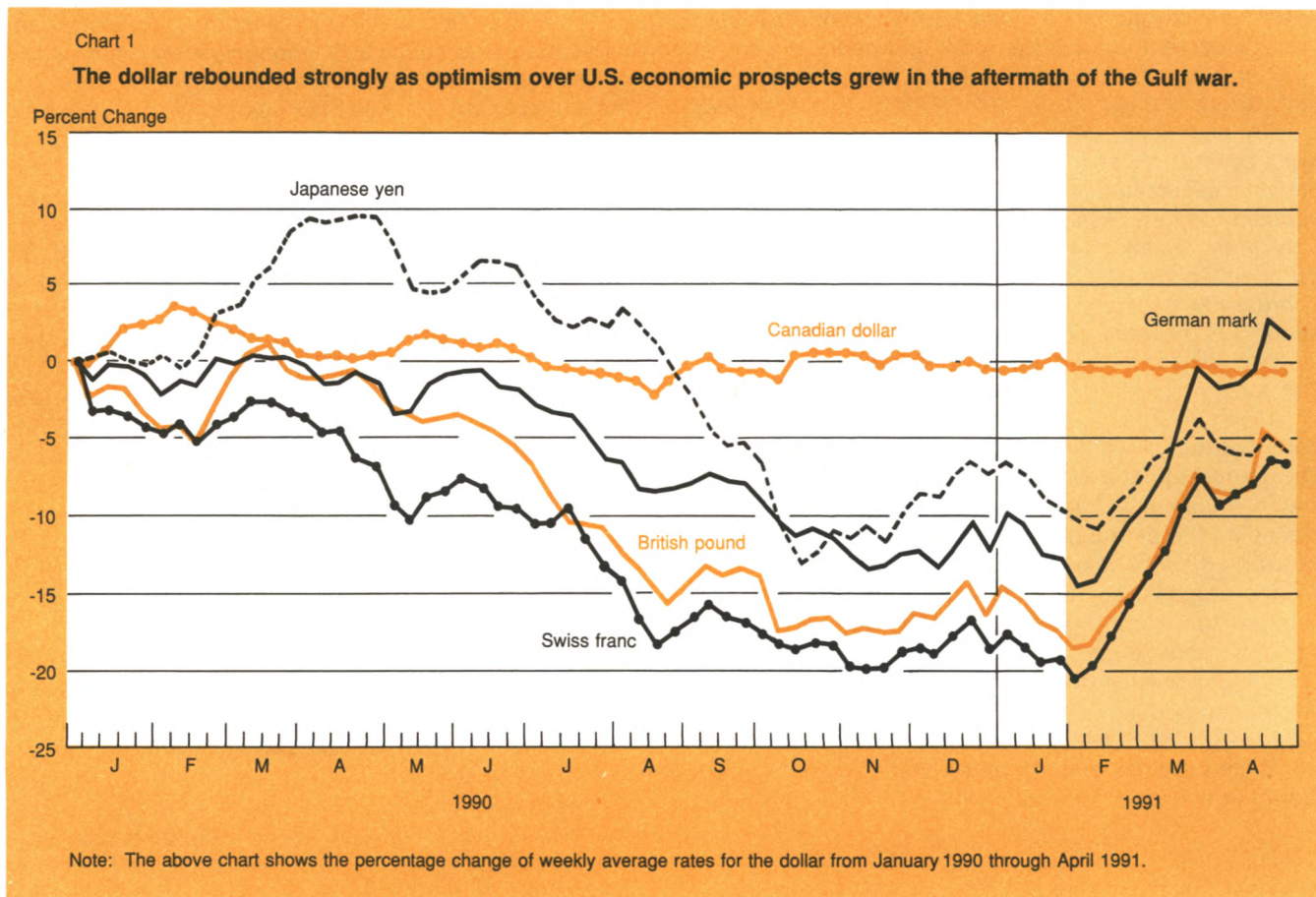
For a time, doubts lingered in the market over official aims and resolve. Official comments suggesting that U.S. economic weakness would be addressed by further interest rate reductions and that other countries might be concerned about the impact of a dollar recovery on their own economies left many market participants believing the authorities were not committed to stopping the dollar's decline. Thus, although the dollar showed somewhat greater stability and at times firmed in response to instances of intervention, sentiment remained generally negative and dollar rates drifted downward on balance. On February 11, the dollar set a new historic low of DM 1.4430 against the mark while

declining to ¥ 127.20 against the yen. At that point the dollar was 2 percent to 3 percent below its level at the end of January and more than 6 percent below its level of January 15, before the commencement of Operation Desert Storm.

Thereafter, the persistence of the central banks and the cumulative impact of their operations, in particular a round of concerted dollar purchases initiated on February 12 by European central banks before U.S. markets opened, finally helped convince market participants of the official commitment to ending the dollar's decline. Market participants paused to reassess exchange rate levels, and a sense of two-way risk returned to the market after a prolonged, albeit not continuous, decline in dollar exchange rates.

Mid-February through March: the dollar recovers
As the dollar steadied, a number of other factors combined to engender a sharp recovery. At first, indications that the Gulf war would end quickly on terms favorable to the United States and its allies buoyed the dollar. On

Chart 1

The dollar rebounded strongly as optimism over U.S. economic prospects grew in the aftermath of the Gulf war.

Note: The above chart shows the percentage change of weekly average rates for the dollar from January 1990 through April 1991.

February 15, a radio broadcast from Baghdad suggesting conditions under which Iraq might withdraw its forces from Kuwait represented the first indication that the war might have reached a decisive point. Then, as the start of the allied ground offensive was seen as bringing the war to a quick end, the dollar gained further support. Market participants, recalling Chairman Greenspan's concerns in January about the economic impact of a long war, associated a short war with an early economic recovery. When the ceasefire was declared February 27, market participants became increasingly confident that the dollar and the U.S. economy would benefit.

Meanwhile, the assumption that interest rate differentials would move inexorably against dollar investments no longer appeared realistic. A number of other countries were beginning to feel the effects of slowing demand, and around mid-February, official interest rates were reduced in the United Kingdom, Spain, the Netherlands, and Belgium. Rumors also circulated of a possible easing in Japan. Meanwhile, German market rates had moved up only modestly following the official rate increase of late January. Together, these develop-

ments called into question the view that the United States would remain alone in pursuing an accommodative monetary policy. At the same time, comments by various Federal Reserve officials, including Chairman Greenspan's Congressional testimony of February 20, reminded market participants that there would be limits to the easing of monetary policy in the United States.

Another factor contributing to the dollar's rise during this period was the possibility that large market purchases of dollars to cover cash contributions for Desert Storm expenses and postwar reconstruction costs in the Persian Gulf might be forthcoming. The approval on March 6 by the upper house of the Japanese parliament of a ¥1.17 trillion contribution to the Desert Storm operation and the prospect that such a large payment might be converted from yen into dollars in the market was a factor affecting the dollar/yen rate during much of the rest of the month of March.

At the same time, concerns began to grow about the implications for the German mark of the problematic economic situation in eastern Germany and of the social and political strife in the Soviet Union. Strikes and demonstrations in eastern Germany idling thousands of workers highlighted the difficulties of the economic restructuring. The decision of the German government late in February to seek a package of tax increases to help finance German unification was taken as an indication that the costs were also likely to be
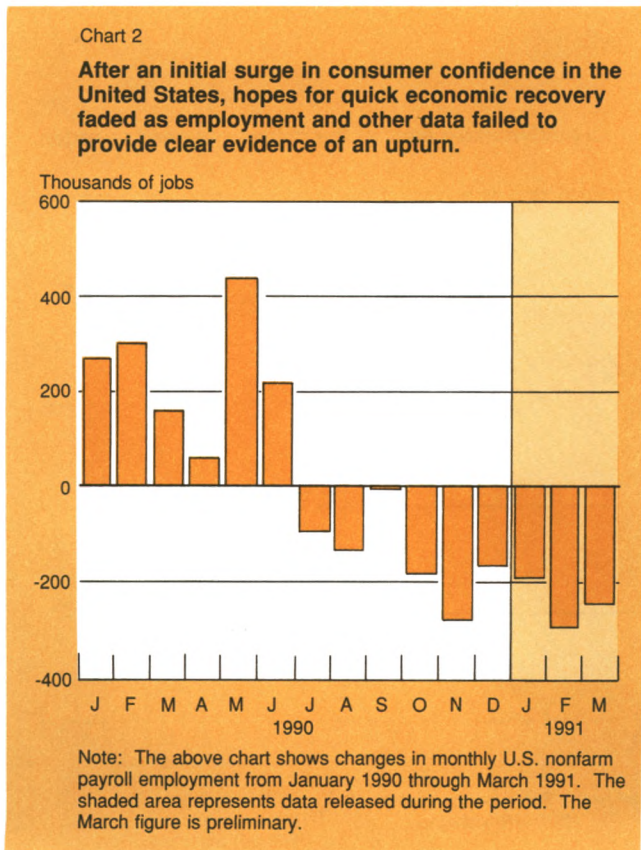
Chart 2

After an initial surge in consumer confidence in the United States, hopes for quick economic recovery faded as employment and other data failed to provide clear evidence of an upturn.

Thousands of jobs

Note: The above chart shows changes in monthly U.S. nonfarm payroll employment from January 1990 through March 1991. The shaded area represents data released during the period. The March figure is preliminary.

Table 1

Federal Reserve Reciprocal Currency Arrangements
Millions of Dollars

Institution	Amount of Facility April 30, 1991
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

greater than previously believed. At about the same time, strains among the republics of the Soviet Union and protests against the leadership of President Gorbachev intensified, leading to a further reassessment of the view that Germany was likely to reap early benefits from liberalization in the Soviet Union and elsewhere in eastern Europe. These and other signs of uncertainty tended to weigh on the mark throughout the period.

For all of these reasons, sentiment towards the dollar had turned quite positive by early March. As the dollar rose, it gathered momentum that neither disappointing economic data nor further easing of U.S. monetary policy appeared to diminish. In early March, the dollar moved up through its January 15 levels. In the days that followed, it was pushed up further as market participants scrambled to cover short positions or to meet previously delayed requirements. The dollar's rise was accelerated at times by actions in the options markets. Writers of foreign currency options that had been purchased when the dollar's direction seemed uncertain hastened to cover their exposure as the likelihood quickly increased that those options would be exercised. The reversal of sentiment also triggered large shifts into dollar investments by portfolio and funds

managers. By the end of March, the dollar had moved above DM 1.70 and ¥140, 18 percent and 10 percent, respectively, above the lows for the period reached six weeks earlier on February 11.

As the dollar continued its upward move during March, exchange rates became increasingly susceptible to sharp movements. The rapid appreciation in the dollar made market participants wary, uncertain whether the dollar's rise would continue, and traders became more reluctant to maintain positions. On March 11, in one episode, the dollar rose sharply against the mark in Asian trading, and a number of European central banks responded by intervening to sell dollars. The U.S. monetary authorities cooperated by selling a total of $200 million against marks and $30 million against yen in New York that same day and later that week to support their efforts in an environment of unsettled market conditions. On March 19 and 22, in another such episode, the U.S. authorities joined other central banks and sold a total of $170 million against marks. Treasury Under Secretary Mulford stated that the U.S. authorities were concerned about the rapidity of the dollar's rise and would continue to cooperate with other central banks.
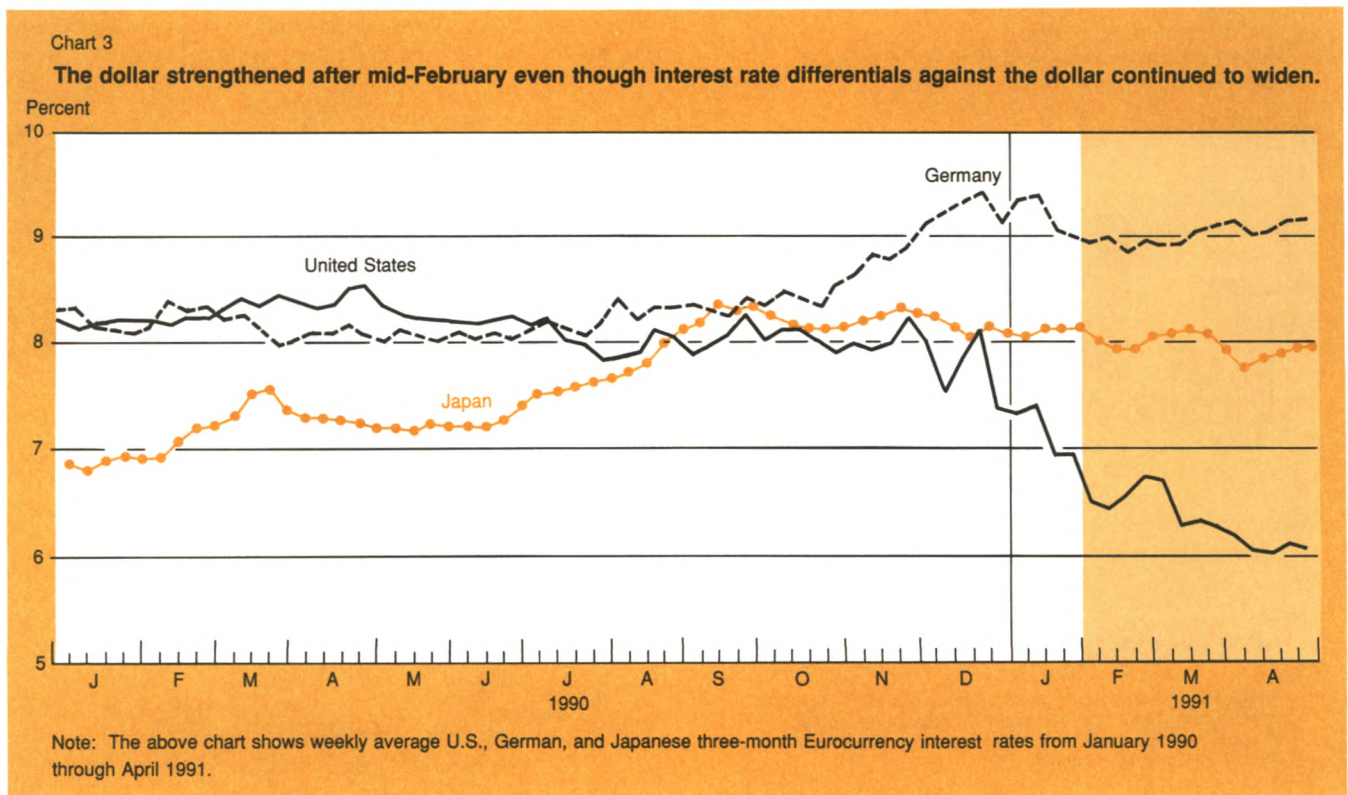
Chart 3

The dollar strengthened after mid-February even though interest rate differentials against the dollar continued to widen.

Note: The above chart shows weekly average U.S., German, and Japanese three-month Eurocurrency interest rates from January 1990 through April 1991.

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

Central Bank Drawing on the U.S. Treasury	Amount of Facility	Outstanding as of January 31, 1991	February	March	April	Outstanding as of April 30, 1991
National Bank of Romania	40.0†	—	—	+40.0 −40.0	—	—

Note: Data are on a value-date basis. Components may not add to totals because of rounding.
†Represents the ESF portion of a $300 million short-term credit facility with the National Bank of Romania that was established on March 4, 1991, and expired on March 28, 1991.

April: the dollar's rise subsides

By early April the initial reaction to the end of the Gulf war had run its course. Market participants then turned their attention to the near-term economic and monetary policy prospects for various countries. With clear trends in these areas difficult to discern, exchange rates fluctuated, sometimes sharply, but with less direction for the balance of the period.

The market's optimism about the near-term U.S. economic outlook was yet to be confirmed by statistical evidence. Employment data released early in April pointed to a continuing drop in jobs after the end of the Gulf war. Also, monetary conditions in the United States continued to ease, and U.S. short-term interest rates were roughly 150 and 300 basis points lower, respectively, than those in Japan and Germany. Yet market participants held to their belief that economic recovery would soon emerge in the United States, and they took note of early April reports suggesting that the Federal Reserve was adopting a more cautious attitude towards easing monetary policy.

In addition, market participants had come to expect that with economic growth slowing or actually turning negative in most of Europe and North America, world interest rates would trend downwards. Canada and the United Kingdom were already embarked on a path of monetary easing in the face of severe recessions. With the exception of Germany, most European countries had already started to lower interest rates, or appeared poised to do so, to the extent that EMS constraints would permit. In Japan, Bank of Japan and government officials continued to express their commitment to a tight monetary policy. Market participants, however, noting the sharp decline in Japanese money supply growth and the apparent stabilization, after steep declines, of asset prices, increasingly came to expect an ease in the weeks ahead, and the yield curve remained steeply *inverted*.

Only for Germany did the market expect that interest

Table 3

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

	Federal Reserve	U.S. Treasury Exchange Stabilization Fund†
Valuation profits and losses on outstanding assets and liabilities as of January 31, 1991	+5,688.0	+3,027.2
Realized February 1, 1991–April 30, 1991	+179.4	+146.9
Valuation profits and losses on outstanding assets and liabilities as of April 30, 1991	+2,316.3	+570.6

Note: Data are on a value-date basis. Valuation profits (losses) represent the increase (decrease) in dollar value of outstanding currency assets valued at end-of-period exchange rates, compared with rates prevailing at the time the foreign currencies were acquired.
†Includes valuation of funds warehoused with the Federal Reserve System.

rates might remain high, or increase further. Adding to the uncertainty about the German situation were the continuing concerns about the Soviet Union, Eastern Europe, and the German government's handling of the challenges of unification. In this context, the dollar rose further against the mark, reaching a seventeen-month high of DM 1.7690 on April 22. In the days that followed, a number of foreign central banks entered the market on several occasions to restrain the dollar's rise against the mark.

As the period drew to a close, market participants began to focus on an upcoming meeting of the Group of Seven (G-7) in Washington. Some sought to protect themselves against the possibility that the G-7 might undertake some action to restrain the dollar's rise. In

addition, there was speculation that the meeting might produce some understandings on interest rates in which most countries except Germany would agree to reduce rates in a more or less coordinated fashion.

When markets first opened on April 29 following the weekend G-7 meeting, the dollar was quickly marked higher in the absence of any explicit statement in the G-7 communiqué of official intention to limit the dollar's rise. After briefly reaching DM 1.7835, the dollar then started to fall back as market participants reconsidered the significance of the G-7 meeting and shifted their focus to the apparent absence of agreement on coordinated interest rate reductions. Many thought that the United States might be the only G-7 member to ease monetary policy in the near term. When in fact the Federal Reserve announced a reduction in the discount rate, effective April 30, the dollar declined further. Altogether, in the last two days of the period the dollar fell nearly 8 pfennigs against the mark, or almost 5 percent, before subsequently stabilizing. Nevertheless, the dollar closed up 15½ percent on balance for the three-month period as a whole, at DM 1.7060. The dollar's movements against the yen in the final days of the period were more moderate, with the dollar closing the period at ¥136.10, up on balance 3¾ percent. The dollar rose 12⅜ percent on a trade-weighted basis as measured by the staff of the Federal Reserve Board of Governors.

During the three-month period, the U.S. monetary authorities purchased a total of $1,389 million, all against German marks, and sold a total of $400 million, of which $370 million was against German marks and $30 million was against Japanese yen. Both the purchases and sales of foreign currencies were shared equally by the Federal Reserve and the Treasury's Exchange Stabilization Fund (ESF).

* * *

In other operations, the Treasury, through the ESF, continued to provide SDRs in exchange for dollars to certain foreign monetary authorities that required SDRs for the payment of IMF charges and for repurchases. The ESF exchanged a total of $87.4 million worth of SDRs during the period. Since these operations began in July 1990, the Treasury has received a total of $971.1 million on sales of nearly SDR 700 million.

On March 6, the Treasury, through the ESF, along with the Bank for International Settlements (acting for certain participating member banks) established a $300 million near-term support facility to assist Romania in its economic adjustment efforts. The ESF share of the facility was $40 million. Romania drew the full amount on March 7. Romania repaid $38.7 million to the ESF on March 20 and, on the following day, repaid in full the remaining balance. The facility expired on March 29.

During the period, the Federal Reserve and the ESF realized profits of $179.4 million and $146.9 million, respectively, from sales of foreign currencies. As of the end of April, cumulative bookkeeping or valuation gains on outstanding foreign currency balances were $2,316.3 million for the Federal Reserve and $570.6 million for the ESF. 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, holdings of such securities by the Federal Reserve amounted to $7,896.7 million equivalent, and holdings by the Treasury amounted to the equivalent of $7,726.2 million valued at end-of-period exchange rates.

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