Federal Reserve Bank of New York

Quarterly Review

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Challenges Facing the International Community of Bank Supervisors

by E. Gerald Corrigan

I am delighted to be here with you in my capacity as Chairman of the Basle Committee on Banking Supervision, and I very much appreciate the extraordinary efforts our French colleagues have made in planning and organizing this conference—efforts that began two full years ago.

These are not the easiest of days for the international community of bank supervisors. Indeed, the challenges and problems we face today are perhaps the most demanding and vexing in the post-World War II period. In these circumstances, it is not at all a simple task to

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try to frame my remarks this morning. For starters, I will give you an overview of the current work and priorities of the Basle Committee. Taken by itself, however, such an overview runs the risk that we will all better see the trees but still will not have a vision of the forest. Accordingly, I will keep my remarks regarding the current work of the Committee relatively brief in order to devote equal time to some of the larger challenges that face the international community of bank supervisors.

Turning first to the current work of the Basle Commit-

tee, the immediate priorities of the Committee can best be captured in several discrete but not unrelated areas of endeavor. In summary form, they are:

First, partly in response to the Bank of Credit and Commerce International (BCCI) episode, the Committee has recently promulgated "Minimum Standards for the Supervision of International Banking Groups and Their Cross-Border Establishments." Since that paper will be the focus of our discussions throughout today's program, I do not intend to go into its details at this time. I do want to stress, however, that from a broad policy perspective, the major thrust of the minimum stan-

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dards paper was aimed at (1) strengthening the application of the principle of consolidated supervision to all internationally active banking groups, (2) adding a further element of discipline to practices surrounding the cross-border establishment and maintenance of banking offices, and (3) promoting a still higher level of communication and coordination among the international community of bank supervisors.

Considerable effort was expended in seeking to achieve these objectives in a flexible manner that

continues to rely heavily on the goodwill existing within the international community of bank supervisors. In this connection, the Committee fully recognizes that there are a number of good and sufficient reasons that current supervisory prac-

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tices in some national jurisdictions may not conform fully to the methods of consolidated supervision typically practiced within the Group of Ten. For that reason, the standards are designed to provide a margin of flexibility, especially for countries that are working toward effective approaches to consolidated supervision of their own banking institutions having, or wishing to have, a cross-border presence. The Committee and its secretariat are fully prepared to work with individual countries or groups of countries in facilitating the transition to the universal application of the policy and practice of consolidated supervision.

The Committee has commissioned a working group of lawyers to look into the problems and difficulties encountered with the post–July 5, 1991 liquidation of BCCI. This "case study" is intended to help better understand the enormous legal and practical problems that can arise in connection with the liquidation of a banking institution with multiple cross-border offices.

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Given the problems encountered with the liquidation of BCCI—and recognizing that BCCI was, in fact, a comparatively small bank in balance sheet terms—the Committee believes that this case study can be helpful in cataloging some of the problems that arise in such circumstances and can suggest some steps that might be taken, either nationally or internationally, to minimize such problems should a similar, or more difficult, case arise in the future.

Over the past several years, the Committee has been engaged in the process of seeking to find sound and workable ways to build into the 1988 Basle Capital Accord explicit *minimum* capital requirements for market risk.

Second, over the past several years, the Committee has been engaged in the process of seeking to find sound and workable ways to build into the 1988 Basle Capital Accord explicit *minimum* capital requirements for market risk. The aim has been to provide for such capital requirements on net open positions in traded debt and equities (including their derivative instruments) that are held in banks' trading books. Similar capital requirements are contemplated for net open foreign exchange positions.

The work of the Committee as it pertains to capital requirements for debt and equities has been proceeding jointly with the work of the Technical Committee of the International Organization of Securities Commissions (IOSCO) in the hope that a comprehensive arrangement that will apply equally to banks and securities firms can be put in place. While considerable progress has been made in reaching this objective, there are a number of important areas in which agreements within and between the two regulatory bodies have yet to be reached.

As those efforts continue, the Basle Committee is mindful that achieving a higher degree of convergence between its efforts and the Capital Adequacy Directive, which is in the final stages of adoption by the European Community, is also desirable. Because of the lengthy consultative and phased implementation process that will have to be associated with the overall market risk effort, the Committee believes that the necessary convergence between Basle and Brussels can be realized over time, and the Committee is fully

prepared to continue to work with our colleagues in Brussels toward that objective.

The approach to capital requirements for market risk that the Committee has in mind entails a two-step process aimed at satisfying two principal objectives. The objectives are: first, that the methodologies used to determine the amount of the capital requirements result in reasonably prudent cushions of capital protection against the potential for declining values in portfolios of traded debt securities, equities, and foreign exchange; and second, that the capital requirements across the three classes of instruments produce roughly equivalent economic results so as not to introduce artificial incentives favoring one class of instrument relative to others.

The specific process for estimating the amount of the minimum capital requirements for each class of instrument is, unfortunately, more complex than the Committee would wish. The complexities arise in part because the activities themselves are complex, but also because the computational techniques must take account of hedging and other complex trading strategies in order to arrive at reasonable approximations for the net open positions to which the capital charge factors would apply.

A two-step process is contemplated for integrating the capital requirements [for market risk] in the 1988 Basle Accord. In the first step, the minimum capital requirements for net open positions for each class of instrument would be calculated. In the second step, the aggregate capital requirements for market risk would have to be integrated with the capital requirements for credit risk under the 1988 framework.

These complexities aside, a two-step process is contemplated for integrating the capital requirements in the 1988 Basle Accord. In the first step, the minimum capital requirements for net open positions for each class of instrument would be calculated. In the second step, the aggregate capital requirements for market risk would have to be integrated with the capital requirements for credit risk under the 1988 framework. Under this approach, the extent to which individual banks will face greater *total* minimum capital requirements than is the case today will vary depending on the size of the bank's *open* positions in these instru-

ments and the extent to which market risk capital requirements are a partial substitute for existing credit risk capital requirements.

Within the context of efforts aimed at convergence with IOSCO and Brussels, the goal of approximating competitive equality across different classes of institutions will entail some limited modification of the definition of capital. Specifically, it is contemplated that banks will be permitted to meet a fraction of the overall capital requirements for *market risk* by using particular forms of subordinated debt in a manner that is similar and proportional to the use of such capital by securities firms. For its part, however, the Committee retains a conservative bias with regard to the definition of capital and would entertain change in the existing definition only for the sake of material convergence with IOSCO and Brussels.

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Within the context of the market risk exercise, the Committee is also exploring the larger question of interest rate risk as it pertains to a bank as a whole. While it would be premature to anticipate the results of these efforts, it is probably safe to say that the Committee has a rather strong predisposition to try to deal with this issue through an approach that seeks to identify "outliers" and to deal with such outliers on a case-by-case basis, rather than a generalized approach that would rely on still another set of additive capital requirements for overall interest rate risk.

The Committee is taking a fresh look at supervisory practice and policy as they relate to various categories of off-balance-sheet activities.

Third, for readily understandable reasons, the Committee is taking a fresh look at supervisory practice and policy as they relate to various categories of off-balance-sheet activities. In part, these efforts are incorporated into the market risk exercise outlined above. Beyond that, we are also looking anew at some of the methodologies and

capital weights that the 1988 Accord applied to the credit risks arising from some of these activities. Finally, and over a somewhat longer time frame, the Committee is mindful that the continued very rapid pace of innovation may require some further changes in basic accounting and statistical reporting requirements for at least some off-balance-sheet activities.

The latter, however, is potentially a very large and very expensive task that must be approached with great care. Partly for that reason, the Committee welcomes the recent creation of the Group of Thirty study group on off-balance-sheet activities. The perspective provided by this and other private initiatives will be of considerable value to supervisors and market participants alike as all parties seek to forge sensible and balanced approaches to the oversight and regulation of off-balance-sheet activities.

The Committee is keenly aware that banking groups by themselves, but especially in combination with insurance and securities firms, are becoming very complex organizations. This trend raises a number of very difficult questions, not the least of which relates to the manner in which the principle of consolidated supervision can be applied effectively to such institutions, especially in the case of so-called financial conglomerates.

Fourth, the Committee is keenly aware that banking groups by themselves, but especially in combination with insurance and securities firms, are becoming very complex organizations. This trend raises a number of very difficult questions, not the least of which relates to the manner in which the principle of consolidated supervision can be applied effectively to such institutions, especially in the case of so-called financial conglomerates. Some of these problems are definitional, including the very difficult task of defining how different regulators with responsibilities for one part of such a conglomerate can best coordinate their activities with other regulators within and across national boundaries.

While these and other practical problems are formidable, a far more difficult issue that can arise in this connection is whether efforts aimed at the supervision of such conglomerates may not, by their very nature, escalate the so-called moral hazard problem in ways that may be unwise from

a broad public policy perspective. This potential problem becomes even more difficult in cases involving mixtures of regulated financial and unregulated nonfinancial entities, especially when the parent or lead entity is an unregulated nonfinancial institution.

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cial relationships between related companies or seeking to "wall off" the bank from its related companies are far from satisfactory on both practical and policy grounds.

In the months ahead, the Committee plans to broaden its efforts in this area by establishing an informal group of experts drawn from the ranks of banking, securities and insurance regulators to look at these issues. It is hoped that this group, together with parallel efforts under way within IOSCO and in Brussels, will shed some more definitive light on how best to approach these most difficult and important questions of practice and policy.

This overview of some of the current initiatives of the Basle Committee is interesting in its own right, but to the community of supervisors its value should lie not in its specifics but rather in the message that those specifics are conveying about the broad environment in which we must discharge our responsibilities. That message is, of course, that the world of banking and finance has become very complex and perhaps more risky as technology, competition, and deregulation irreversibly alter the framework within which financial institutions and their supervisors must function. As I said earlier, I believe a case can be made that the challenges facing the international community of supervisors are as great today as they have been at any time in the postwar period. That being the case, it is important that we have a vision as to what may lie ahead as we seek to adapt our ideas and our ideals in a manner that is sensitive to the past but alert to the future.

With that in mind, let me now share with you some thoughts I have about some of the challenges that may confront us in the period ahead. I hope that this overview will help us better see not merely *what* we should be doing but, more important, *why* we should be doing it. I will try to provide some of this perspective by

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referring to four particular points of interest and will then close with some comments on recent experiences that a number of countries have had with debt-induced bubbles in real estate and other asset prices. The four particular points of reference include the following:

First, given all of the banking and financial problems that have emerged over the past ten years, one must be impressed with the resilience of the international banking and financial system. Indeed, whether it was the LDC debt crisis, bank

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failures or near failures, the stock market crash, real estate and other asset price bubbles, the recent turmoil in foreign exchange markets, or the financial scandals that have rocked many markets and institutions, the system has held up remarkably well. Moreover, in the face of all of this turmoil, and in no small way reflecting the impetus provided by the 1988 Basle Capital Accord, many banks and national groups of banks have substantially strengthened their capital base in recent years. At the same time, many developing countries as well as the nations of Eastern Europe and the former Soviet Union have made notable progress in the development of market-based banking systems in which private ownership of banks is the emerging trend.

When we consider all that has been achieved and all that *might* have gone wrong over this period, it would be easy for bankers and supervisors to conclude that the worst is behind us and

smooth sailing lies ahead. Unfortunately, I believe that any such conclusion would be distinctly premature. For one thing, we all recognize that the global economic outlook is subject to consider-

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able uncertainty. We also know that the well-being of the international banking system is by no means independent of the near- to intermediate-term prospects for economic performance. For this reason alone, supervisors can ill afford to relax the vigilance that has been heightened over recent years. Indeed, I would go one step further and suggest that still greater efforts are needed (1) to further strengthen supervisory policies and practices and (2) to shape those policies and practices in a manner that recognizes and rewards the strong and the prudent while penalizing the weak and the reckless. To put it differently, the many strong and well-managed institutions should not be held hostage to supervisory policies and

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practices that are driven by the mistakes or misdeeds of the few. Achieving this more selective approach to dealing with problems and abuses becomes all the more important in a setting in which banks in most countries are now facing very stiff competition from less regulated, or even essentially unregulated, nonbank institutions.

Second, while we are all understandably preoccupied with the daunting task of trying to keep pace with the latest developments in this world of "high-tech" banking and finance, we should remember that, almost without exception, the most serious banking problems encountered in

recent years have grown out of old-fashioned difficulties with bad loans and excessive concentrations. That, of course, is not meant to suggest that we can ignore contemporary developments. But it does mean that as we seek to cope with new trends and new risks, we cannot relax our surveillance, inspection, and examination programs as

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they pertain to traditional concerns about asset quality and concentrations. For many supervisory authorities—certainly including the Federal Reserve—these dual concerns with new and old sources of problems will mean that still greater and more sophisticated resources—people and technology—will have to be devoted to the supervisory process. This will be costly, but the alternative would be even more costly.

Third, while we and others can all engage in a lively debate about whether international banking in the nineties is likely to be more or less risky than it has been in the past, I believe we would all be well served to operate on the *assumption* that systemic risk may be greater as we look ahead. I say this with the full knowledge that various hedging techniques provide ample opportunities for individual institutions to manage and contain their risks. My suggestion that systemic risk may nonetheless be greater might therefore seem contradictory, but it is not. The reason that it is not is that

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the speed, volume, value, and complexity of international banking transactions have introduced new linkages and interdependencies between markets and institutions that have the potential to transmit problems and disruptions from place to place and institution to institution at almost

breakneck speed.

This is the fundamental reason that supervisors must be concerned about the astronomical growth of off-balance-sheet and related activities and about the financial and operational integrity of national and international payment and settlement systems. It is also why supervisors and practitioners alike must redouble efforts to design and implement truly safe and robust netting systems even though we all recognize that the legal and other obstacles standing in the way of that objective are very formidable, especially in an international setting.

Fourth, for better or for worse, banking supervision has taken on a high public profile in many countries. In the wake of all the problems of the past ten years, that is understandable. And in many ways we should welcome that higher public profile, even if it carries with it the sometimes uncomfortable feeling of greater accountability.

This heightened public profile [of banking supervision] is not, however, without its problems. For example, it can bring with it the suggestion that prudential policies should be used in a countercyclical fashion, an approach that strikes me as very dangerous indeed.

This heightened public profile is not, however, without its problems. For example, it can bring with it the suggestion that prudential policies should be used in a countercyclical fashion, an approach that strikes me as very dangerous indeed. Similarly, it can bring with it the misguided belief that bank supervisors should be able to detect and prevent every problem, including fraud, deceit, and dishonesty. Finally, it can bring with it the wholly misguided notion that bank supervisors are surrogate bank managers, thus blurring if not erasing the vital distinction between the role of bank supervisors on the one hand and bank managers on the other.

I raise these potential dangers in part because they can become quite real but also because they should remind us of a much more fundamental point. Namely, banking supervision is an art, not a science. It cannot be, and should not be, failsafe. It cannot be, and should not be, reduced to a series of formulas and ratios. Its principal focus should be the well-being and safety of the system as a whole. Its principal modus operandi should

be hard and rigorous analysis, generously seasoned with experience and judgment. But it is up to the supervisory community itself to understand and to articulate the objectives and limitations of the supervisory process. To the extent that the community of supervisors does this well, it will flourish in the sunshine of its heightened public profile.

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Earlier I said that I believe it would be distinctly premature for banks and bank supervisors to conclude that the worst is behind us and that smooth sailing lies ahead. One very forceful reminder of why I hold that belief can be found in the fact that so many countries—starting with my own—are mired in patterns of sub par economic growth, the causes of which are at least partially related to credit-induced real estate and other asset price bubbles during the second half of the 1980s.

To some extent, this phenomenon can be explained by country-specific developments. For example, informed observers generally cite some or all of the

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following in seeking to explain the situation in the United States: (1) the combination of the 1981 and 1986 tax acts, (2) the growing importance of nonbank financial institutions, (3) the rapid growth in capital markets in general and securitization in particular, and (4) technological change and innovation in banking and finance. While it is no doubt true that these factors played a role in the debt and real estate excesses in the United States, they do not appear to have been nearly as important—and, in the case of the U.S. tax legislation, not even present—in other countries that have experienced similar ailments.

Thus we face the nagging question why so many countries, in seemingly different national circum-

stances, experienced broadly similar problems. One possibility is that the incidence and timing of these problems were sheer coincidence. Another is that these developments can be attributed to sunspots or some mystical phenomenon. Still another—and the more plausible—possibility is that there are common denomi-

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nators that can help to explain why these events have occurred in so many places at about the same time.

The obvious place to look for common denominators would be in the area of macroeconomic performance. Specifically, history would suggest that credit-induced speculative bubbles would be most likely to occur in circumstances of high and accelerating inflation and low or negative real interest rates. On the whole, however, these conditions were not characteristic of the period in question. That is, while inflation was clearly a matter of continuing concern in most countries, there was not a widespread outburst of generalized and cumulating inflationary behavior. And in most countries, real interest rates, as generally measured, were distinctly on the high side relative to historical norms.

Despite these considerations, two phenomena seem to have been more or less common to the countries that experienced credit-induced speculative bubbles. Those two common elements are as follows: first, it does

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Two phenomena seem to have been more or less common to the countries that experienced credit-induced speculative bubbles.... First, it does appear that the rise in land and/or real estate prices tended to be much greater than the general rate of inflation; and, second, it appears that the rise in private debt accumulation relative to nominal GNP was more rapid than would normally be expected.

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appear that the rise in land and/or real estate prices tended to be much greater than the general rate of inflation; and, second, it appears that the rise in private debt accumulation relative to nominal GNP was more rapid than would normally be expected. In these areas the correlations are less than perfect but the tendencies are clear enough. But even if the correlations were nearly

perfect, that would still raise the question why these tendencies developed.

In other words, why did developers and others borrow so much (especially at seemingly high real interest rates) and why did institutions and markets provide so much credit when, at least in the United States, half-empty or empty office buildings could be seen simply by looking out the window of the office in which the agreements for still more construction loans were being signed?

Part of the answer to that question is obvious in that borrowers and lenders alike had to have believed that inflation—at least of a selective nature—would eventually bail them out. It is perhaps also true that decisions to lend and to borrow were easier to reach and to justify in the "go-go" financial environment of the 1980s. Whatever the precise psychology of the situation, the financial culture of the 1980s was somewhat similar to the boom and bust environment of the nineteenth and early twentieth centuries, a similarity that was no doubt nurtured by the fact that so many of the direct participants to the process of the 1980s lacked the historical experience or the perspective of these earlier times.

Looked at in this broad light, several things can be said: first, to some extent the credit excesses of the 1980s can be partially explained by a number of country-specific factors; second, notwithstanding a relatively benign overall inflationary environment and relatively high real interest rates, borrowers and lenders alike

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Some part of those excesses had to have been encouraged by at least selective inflationary expectations and by a culturally induced "disconnect" with earlier history and experience.

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clearly went overboard; third, some part of those excesses had to have been encouraged by at least selective inflationary expectations and by a culturally induced "disconnect" with earlier history and experience. These considerations probably constitute a reasonable summary of the *necessary* conditions for the widespread incidence of credit-induced speculative bubbles in so many countries, but they do not constitute *sufficient* conditions to explain all we have seen. Those missing sufficient conditions are, in my judgment, to be found in the application of very sophisticated telecommunications and computer technology to money, finance, and economic activity more generally, with all of their implications for the globalization of financial markets and institutions.

We all know that technology has profoundly changed

the day-to-day business of banking and finance. Some of that change is an outgrowth of the speed and ease with which information can be assembled and communicated; some of it is an outgrowth of the speed, relative safety, ease, and low cost with which money and capital can move from place to place around the globe; and some of it relates to computational capabilities that make possible the design of financial instruments, trading practices, and investment strategies that would have seemed almost unimaginable only a few short years ago.

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The advances in the technology of information processing, transactions processing, and computational capabilities have made it much easier and "cheaper" for borrowers and lenders to tap fresh sources of capital and finance and to arbitrage not simply interest rates and exchange rates, but even price differentials between office buildings and shopping centers on a global scale.

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fresh sources of capital and finance and to arbitrage not simply interest rates and exchange rates, but even price differentials between office buildings and shopping centers on a global scale. These technological forces are also one of the fundamental reasons that the value of the traditional bank "franchise" has been reduced in many countries, thereby introducing important new elements of competition in the financial marketplace that may permit, if not encourage, a higher degree of overall leveraging than might otherwise have been the case. All of this, I believe, is the missing link in efforts to explain why credit-induced asset price bubbles have been able to move with such relative ease from one spot on the globe to another.

Taken as a whole, the foregoing analysis raises two important questions: first, was the experience of the late eighties a onetime phenomenon or has the character of finance changed so fundamentally that we will see the experience of the last several years repeat itself—with all of its implications for economic performance and stability? Second, what does all of this imply for supervisory policies and practices?

The answer to the first of those questions does not come easily. On the one hand, it can easily be argued that the costs to borrowers and lenders alike for the excesses of the 1980s have been so large that the hard

lessons learned will not be forgotten quickly or easily. I hope that will be the case, but if it is, it presupposes a renewed and pervasive commitment to the principle of prior restraint in the credit origination process on the part of borrowers and lenders alike. It also implies the need for what I will call the "taming of technology," and by that I mean the fuller development of risk management and management information systems that will provide the top management of financial institutions with the tools and the information to ensure that applied technology is being used in a safe, sound, and prudent

The realities of today's and tomorrow's world of banking and finance will place an even greater premium on the time-honored basics of strong management, diversification of risks, a thick capital cushion, and broad and deep liquidity.

manner. Fortunately, great progress is being made in this area, but still greater strides will be needed even though such efforts are very expensive and very time consuming. Beyond that, the realities of today's and tomorrow's world of banking and finance will place an even greater premium on the time-honored basics of strong management, diversification of risks, a thick capital cushion, and broad and deep liquidity. With these elements firmly in place, the likelihood is great that we can avoid a repeat of the excesses of the second half of the 1980s.

However, even if things do work in that happy direction, the task ahead for the supervisory community will

be great indeed. For one thing, the hangover from the excesses of the 1980s is far from behind us, even though considerable progress has been made in that regard. But even as that process continues and even as

The hangover from the excesses of the 1980s is far from behind us, even though considerable progress has been made in that regard. But even as that process continues and even as macroeconomic prospects brighten—as they surely will over time— the supervisory community must do its part to help ensure that the international banking system will reach calmer waters.

macroeconomic prospects brighten—as they surely will over time—the supervisory community must do its part to help ensure that the international banking system will reach calmer waters. In seeking to play our necessary role in facilitating that transition, none of us is capable of foreseeing all that may lie ahead. Yet our agenda is clear enough, even though fulfilling that agenda will require an enormous amount of effort and the willingness and flexibility to respond to unforeseen developments.

We know that there will be problems and pitfalls. We also know that a great deal is expected of us—perhaps more than is reasonable. But with vision and vigor, with intelligence and integrity, and above all, with the expectation for the best but a healthy respect for the worst, I am confident that we can and will succeed.

Bank Capital Ratios, Asset Growth, and the Stock Market

by Richard Cantor and Ronald Johnson

In recent quarters, the U.S. banking system has rapidly improved its capital strength. Motivated by strategic business opportunities and regulatory pressures, bank holding companies now appear to be targeting capital ratios well above the minimums set by regulation. The current drive for capital is apparently being rewarded by private investors: those bank holding companies that have significantly increased their capital ratios, particularly those that began from initially low levels, have experienced large appreciations in their stock prices.

This article tracks three important capital-to-asset ratios for the banking system: 1) the leverage ratio (book value of tangible equity to total assets), 2) the tier 1 risk-based ratio (tangible equity to total risk-adjusted assets), and 3) the total—that is, tier 1 plus tier 2—risk-based ratio (tangible equity plus secondary capital instruments to total risk-adjusted assets). We identify the broad changes that have taken place in these ratios over an eighteen-month period and the reasons for the improvement in capital measures. Central to this effort is an examination of the various actions taken by bank holding companies to boost their capital ratios. We analyze the relationship between these "strategies"— all moves to raise capital or shrink assets—and the rewards assigned to them by the stock market.

The evidence suggests that, as a simple accounting matter, almost all of the aggregate improvement in the leverage ratio has been due to equity growth, mostly through stock issuance. The risk-based capital ratios have risen even more than the leverage ratio because risk-weighted assets have declined more sharply than total assets as banks have curtailed loan growth and purchased securities. These aggregate trends mask differences in the strategies adopted by individual bank

holding companies to improve their capital ratios. For example, institutions with initially low capital ratios and weak public bond ratings have reduced their assets or slowed their acquisition of assets much more than other bank holding companies.

Our analysis of the stock market response to the various methods of improving capital ratios shows that different strategies have garnered different rewards. For bank holding companies that were well capitalized at the beginning of the sample period, stock price appreciation was more highly correlated with capital ratio improvements achieved through capital growth than with improvements through asset reduction. For weakly capitalized institutions, however, the stock market appears to have rewarded capital growth and asset shrinkage about equally. For all institutions, we find that stock prices responded in about the same proportion to a reduction in total assets as to a decline in risk-weighted assets. Of the various ways that companies increased capital, increases in earnings were, not surprisingly, associated with the largest stock price increases. Nevertheless, building capital by other methods, such as limiting dividends and issuing stock, also appears to have been rewarded by the stock market.

Background on the current capital regulations[1]

Banks and bank holding companies are required to meet minimum capital standards calculated on both a simple leverage basis and a risk-adjusted basis. The

[1]Further elaboration can be found in the testimonies of William Taylor, late Chairman of the Federal Deposit Insurance Corporation, and Jerome Powell, Under Secretary for Finance, Department of the Treasury, given at the hearings on "Capital Standards and Credit Availability," House Committee on Small Business, July 9, 1992.

leverage standard specifies that a certain minimum amount of tangible equity be held against total assets. The risk-based standard is more complex, incorporating both equity and other forms of capital and measuring both assets and off-balance sheet exposures on a risk-adjusted basis. The current capital guidelines for banks and bank holding companies were adopted in early 1989 (with certain interim rules effective at year-end 1990 and final rules effective as of year-end 1992).[2] The risk-based guidelines are based on an international agreement called the Basle Accord, negotiated by bank regulators from the major industrialized countries under the auspices of the Bank for International Settlements in Basle, Switzerland.

Under the risk-based standard, risk weights are assigned to different asset categories. Cash and U.S. government securities are given zero risk weight; municipal securities, federal agency securities, and interbank obligations, a 20 percent risk weight. Loans (first liens only) secured by residential real estate are assigned a 50 percent risk weight. Other assets, including most consumer and business loans, are given a risk weighting of 100 percent. In addition, credit equivalencies assigned to off-balance-sheet activities such as loan commitments, letters of credit, and swaps are risk weighted and added to the risk-adjusted assets on the balance sheet to arrive at total risk-weighted assets.

As of year-end 1992, all banks and bank holding companies will be required to maintain tier 1 capital, essentially tangible common equity and most preferred stock, in excess of 4 percent of risk-weighted assets. The risk-based standards also define a broader measure of capital, total capital, which combines tier 1 with tier 2 capital. The latter designation applies primarily to subordinated debt, mandatory convertible securities, and loan loss reserves (up to a maximum of 1.25 percent of risk-weighted assets). In addition to satisfying the tier 1 capital requirement, banks and bank holding companies must maintain total capital in excess of 8 percent of risk-weighted assets.

The leverage ratio requirement was designed to supplement the risk-based capital framework established under the Basle Accord. As originally formulated, the risk-based system principally addressed broad categories of credit risk associated with particular depository institution assets and off-balance-sheet activities rather than interest rate risks and other noncredit banking risks. The leverage ratio was intended to compensate for these gaps in the risk-based capital requirements. The leverage ratio is defined as the ratio of tier 1 capital

to average tangible assets. The minimum leverage ratio requirement for individual banks and bank holding companies varies with their examination ratings and activities and with other factors. Under current regulations, a bank or bank holding company may maintain a leverage ratio as low as 3 percent if the institution is in very sound condition and not experiencing or anticipating significant growth. As a practical matter, minimum leverage ratios for most institutions are about 4 to 5 percent.[3]

The Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) requires that bank regulators publish interest rate risk regulations by June 1993. On July 31, 1992, the Federal Reserve Board, the Federal Deposit Insurance Corporation, and the Office of the Controller of the Currency jointly put forward for public comment a proposal incorporating interest risk in the risk-based capital standards. The agencies have stated that they may lower or eliminate the leverage capital requirement once interest rate risk is included in the risk-based capital framework.[4]

Banks and bank holding companies have strong regulatory incentives to maintain capital levels in excess of the required minimums. Regulators require that banks and bank holding companies experiencing or anticipating rapid growth maintain capital ratios well above the stated minimums. Moreover, to implement section 131 of FDICIA, regulators have recently refined the existing capital standards to recognize different degrees of capital strength. In particular, specific capital "zones" have been adopted by bank regulators for use in (1) determining eligibility for brokered deposits, (2) setting risk-based premiums for deposit insurance, and (3) prompting corrective regulatory actions. Under this scheme, banks are assigned to capital adequacy groups as follows:[5]

Well capitalized: The bank's tier 1 risk-based ratio is greater than 6 percent, total risk-based ratio is greater than 10 percent, and leverage ratio is greater than 5 percent.

[3]See the testimonies of William Taylor and Jerome Powell on "Capital Standards and Credit Availability." Regulations require a 3 percent minimum leverage ratio for banks with the highest examination ratings; however, the minimum capital ratio is 100 to 200 basis points higher for most other institutions. The appropriateness of a bank's leverage ratio is reviewed by its primary regulator.

[4]See the testimonies of William Taylor and Jerome Powell on "Capital Standards and Credit Availability."

[5]See, for example, "Proposals to Implement Prompt Corrective Actions for Undercapitalized State Member Banks," Federal Reserve Bank of New York, Circular no. 10552, July 13, 1992.

[2]The guidelines for bank holding companies and state-chartered banks that are members of the Federal Reserve System are laid out in the "Capital Adequacy Guidelines," 12 CFR 208, appendix A, and 12 CFR 225, appendixes A and B.

Undercapitalized:[6] The bank's tier 1 risk-based ratio is less than 4 percent, total risk-based ratio is less than 8 percent, or leverage ratio is less than 4 percent.[7]

Adequately capitalized: The bank is neither well capitalized nor undercapitalized.

In the discussion below, we sometimes combine the adequately capitalized and undercapitalized bank holding companies into a single "weakly capitalized" group.

Recent changes in the aggregate capital ratios and balance sheets
Our analysis focuses primarily on bank holding companies rather than banks, even though both are subject to the same minimum capital requirements.[8] We concentrate on the holding companies for three reasons. First, bank holding companies generally make and execute the key financing decisions for the banks, including decisions about dividend policy and capital market issuance. Second, because bank holding companies have some flexibility to transfer capital from one subsidiary to another, the consolidated strength of a bank holding company may be the best measure of the long-run capital strength of any individual subsidiary bank.[9] Third, bank holding companies issue most of the publicly traded stock of U.S. banking organizations.

Our basic sample consists of all bank holding companies with assets greater than $150 million that reported risk-based capital and assets in the FR Y-9C reports filed with the Federal Reserve for September 30, 1990. This is the first date that bank holding companies were required to report risk-weighted assets. (A few small institutions did not comply and had to be dropped from the sample.) The most recent data available to us are for the reporting period ending March 31, 1992.

[6]This definition of undercapitalized includes the banks defined in the regulations as "significantly undercapitalized" and "critically undercapitalized."

[7]Banks that have the highest examination ratings and are not experiencing or anticipating significant growth are not undercapitalized if they maintain a leverage ratio in excess of 3 percent.

[8]To date, the various capital zones adopted in connection with FDICIA apply only to banks. We have chosen to apply these zones to bank holding companies only for the purposes of our analysis.

[9]Bank holding companies are discouraged by their regulators and the credit rating agencies from excessive "double leverage," that is, from downstreaming significantly more equity to their subsidiaries than they have in equity on a parent-only basis.

Altogether, the sample comprised 1082 bank holding companies in the beginning of the period and 983 at the end.

Consolidation within the industry has been very rapid. A total of ninety-nine bank holding companies (9.1 percent of sample) with $237 billion in assets (7.9 percent of the sample) "exited" by March 31, 1992 (that is, they did not file a FR Y-9C report for that date). Most exiting bank holding companies either merged with other bank holding companies or were closed by the Federal Deposit Insurance Corporation (FDIC). Bank holding companies that exited through merger are part of the sample at the start of the period and, in a sense, remain in the sample at the end because their assets and capital appear on the balance sheet of an acquirer. The consolidation process is continuing: numerous mergers have been effected since March 31, 1992, and others are being planned.[10]

In general, the holding companies in the sample substantially strengthened their capital ratios over the eighteen-month period (Table 1). Specific improvements included a 1.4 percentage point rise in the tier 1 risk-based capital ratio, a 1.8 percentage point rise in the total risk-based capital ratio, and a 0.7 percentage point rise in the tier 1 leverage ratio. Underlying the improvements in the capital ratios were strong tier 1 capital growth (12.1 percent), slightly negative asset growth (-1.2 percent), and shrinkage of risk-weighted assets (-7.8 percent). The composition of assets shifted toward those with low risk weights. Holdings of securi-

[10]We did not attempt to construct pro forma combinations as of September 30, 1990, for bank holding companies that merged before March 31, 1992, because such combinations obscure the fact that weak bank holding companies are being absorbed by the strong. In most cases, the acquirer must raise additional equity following a merger to maintain its initial capital ratios. In this sense, mergers are similar to other forms of asset growth in that they absorb capital. Moreover, each merger is different and pro forma combinations mask the differences. For example, in a merger of "equals," the bank holding company designated the acquirer may not need to raise any additional capital to maintain its earlier capital ratios after the merger, whereas in an FDIC-assisted merger, the bank holding company targeted for acquisition has no equity and the acquiring bank holding company will probably need to issue new equity.

Large mergers during the period analyzed include Chemical/Manufacturers (assets, $66 billion), Nationsbank (NCNB)/C&S-Sovran ($50 billion), Fleet/Bank of New England ($23 billion), First Union/Southeast ($15 billion), Society/Ameritrust ($11 billion), Wachovia/South Carolina National ($7 billion), Norwest/United Banks of Colorado ($6 billion), and ABN Amro/European American ($5 billion). The mergers of Bank of America/Security Pacific ($73 billion), Comerica/Manufacturers National ($14 billion), and Bank One/Valley National ($11 billion) were not completed as of March 31, 1992. The sample does not include the 160 bank holding companies with $46 billion in assets that filed FR Y-9C reports for March 31, 1992, but not for September 30, 1990. Many of these are newly formed bank holding companies. In general, the entrants have better than average capital ratios. (One entrant is a $6 billion credit card company, MBNA, which was spun off to private investors by MNC Financial during the sample period.)

ties rose sharply (16.9 percent), while loans fell (-7.0 percent).[11] On a risk-weighted basis, off-balance-sheet items shrank (-13.1 percent) more rapidly than on-balance-sheet items (-6.6 percent). Among the off-balance-sheet items, foreign exchange and interest rate contracts declined (-7.2 percent, on a risk-adjusted basis),[12] but less sharply than other off-balance-sheet

items (-13.8 percent) such as unused loan commitments and letters of credit. Nonperforming assets rose 19.0 percent, a rate faster than the growth in loan loss reserves (3.4 percent). Although bank holding companies with low tier 1 capital ratios were probably not reserving aggressively, loan loss reserve growth may also have been weak because over half of all reserves do not qualify as tier 2 capital (qualifying reserves are limited to 1.25 percent of risk-weighted assets according to the final year-end 1992 rules).

The changes in equity and supplemental capital components for bank holding companies that filed FR Y-9C reports both at the beginning and end of the sample period are recorded in Table 2. Here we see the components of capital growth, including net income, dividends, capital market issuance, and equity acquired through mergers. Equity is acquired through a merger when a bank holding company assumes both the assets and liabilities of another financial institution.[13] To raise

[11]Board of Governors of the Federal Reserve System, "Senior Loan Officer Survey on Bank Lending Practices," August 1992, reports the explanations given by loan officers for their banks' decision to increase securities holdings over the last two and one-half years. Among the fifty-nine respondents, thirty-five indicated that securities offered greater profits, thirteen emphasized the uncertain economic outlook, eleven cited a need to fund anticipated increases in loan demand, nine stressed a desire to improve their risk-based capital ratios, and nine gave other reasons. (Banks were allowed more than one answer.)

[12]This decline was due to a decrease in the replacement value of outstanding foreign exchange contracts. The replacement values of interest rate contracts and the notional values of both interest rate and foreign exchange contracts continued to rise throughout the sample period. Moreover, the aggregate risk-weighted amount of swaps could be volatile: mostly flat over the sample, the amount of swaps spiked upwards on December 31, 1991.

[13]The different methods of accounting for equity acquired through mergers are discussed in William LeCates, "Accounting for Bank Mergers," Federal Reserve Bank of New York, memorandum, June

Table 1

Assets and Capital of Bank Holding Companies Reporting for 1990-III

	September 30, 1990	March 31, 1992	Level Change
Capital ratios (percent)			
Tier 1 risk-based ratio	6.5	7.9	1.4
Total risk-based ratio	9.5	11.3	1.8
Leverage ratio	5.5	6.2	0.7
Number of bank holding companies	1082	983	-99
	Billions of Dollars	Billions of Dollars	Percent Change
Assets	3,003	2,965	-1.2
Loans	1,923	1,787	-7.0
Securities	490	573	16.9
Other assets	590	606	2.6
Risk-weighted assets	2,508	2,314	-7.8
On balance-sheet	2,064	1,928	-6.6
Off balance-sheet	445	386	-13.1
Interest rate and foreign exchange contracts†	45	41	-7.2
Other items	400	345	-13.8
Nonperforming assets‡	93	110	19.0
Loan loss reserves	50	52	3.4
Tier 1 capital	164	184	12.1
Tier 2 capital	74	77	4.5

Notes: The sample consists of all bank holding companies with assets greater than $150 million that filed FR Y-9C reports, including reports of risk-weighted assets, for 1990-III. The sample includes the ninety-nine bank holding companies with $237 billion in assets that "exited" before 1992-I, mostly through mergers or regulatory closures. The sample does not include the 160 bank holding companies with $46 billion in assets that filed Y-9C reports in 1992-I but not in 1990-III. Many of these are newly formed bank holding companies.

†The decline in swap-related risk-based assets is due to a drop in the replacement value of foreign exchange contracts. Notional values of both foreign exchange and interest rate contracts and replacement values of interest rate contracts continued to rise during the period.

‡Nonperforming assets consist of nonaccruing loans, accruing loans past due ninety days or more, restructured loans, and real estate acquired through foreclosure.

equity, bank holding companies relied chiefly on common stock issuance ($9.3 billion) and preferred stock issuance ($5.3 billion). Most net income during this period ($15.6 billion) was absorbed through dividends on common stock ($10.4 billion) and preferred stock ($1.7 billion). Retained earnings were more important for many bank holding companies than the aggregate statistics would suggest, however, because other companies experienced losses over this period.

Subordinated debt growth was also strong ($9.8 billion); yields on debt securities for many bank holding companies fell sharply after reaching junk bond heights in late 1990. Mandatory convertible securities were on net retired (−$3.6 billion), a predictable development given that these instruments count only as tier 2 capital under the risk-based capital guidelines but had been a core capital component under the "primary capital guidelines" in place before 1991. Loan loss reserves increased for this sample (which differs substantially

Footnote 13 continued
9, 1992. Since bank holding companies in the sample maintain a ratio of assets to equity of about 16.5, the $10.3 billion in equity acquired through mergers could support up to about $170 billion in merger assets before the bank holding companies would have to raise additional capital.

from the sample analyzed in Table 1), largely owing to mergers; however, virtually none of the additional reserves qualified as tier 2 capital, because the shrinkage of risk-weighted assets reduced the amount of reserves allowable for regulatory capital.

The distribution of bank holding companies across capital adequacy groups

Applying the capital adequacy definitions adopted for banks in connection with FDICIA, we find that both the number and the asset share of bank holding companies that would be deemed "well capitalized" have increased.[14] Chart 1 depicts the change in the distribution of bank holding companies and bank holding company assets across the three capital adequacy zones

[14]For simplicity, we have categorized all bank holding companies with leverage ratios below 4 percent as undercapitalized, although banks and bank holding companies with strong examination ratings may be permitted to operate with leverage ratios as low as 3 percent.

Table 2

Changes in Equity and Supplemental Capital Components between 1990-III and 1992-I

In Billions of Dollars

Changes in equity

Equity acquired through business combinations (mergers)	10.3
Net income	15.6
Less dividends on common stock	10.4
Less dividends on preferred stock	1.7
Equals retained earnings	3.4
Net issuance of common stock	9.3
Net issuance of preferred stock	5.3
Other increases in equity[1]	0.5
Equals total increase in equity[‡]	28.8

Changes in supplemental capital

Subordinated debt	9.8
Mandatory convertible securities	−3.6
Loan loss reserves (total)	7.5
Loan loss reserves qualifying for tier 2 capital[§]	0.1

Note: Sample is limited to those 983 bank holding companies that filed FR Y-9C reports for both 1990-III and 1992-I.

[1]Increases consist of a variety of accounting adjustments to equity, including foreign currency translation adjustments, cumulative effects of earlier changes in accounting principles, and corrections for past accounting errors.

[‡]Total increase differs from the change in tier 1 capital reported in Table 1 by roughly the equity acquired through mergers net of goodwill.

[§]As of year-end 1992, loan loss reserves up to a maximum of 1.25 percent of risk-weighted assets qualify as tier 2 capital.

Chart 1

Distribution of Bank Holding Companies across Capital Adequacy Groups

Notes: Sample for 1990-III (1992-I) consists of 1082 (983) bank holding companies representing $3,003 ($2,965) billion in total assets. Bank holding companies are assigned to capital adequacy groups as follows: 1) well capitalized if tier 1 risk-based capital ratio is greater than 6 percent, total risk-based capital ratio is greater than 10 percent, and leverage ratio is greater than 5 percent; 2) undercapitalized if tier 1 risk-based capital ratio is less than 4 percent, total risk-based capital ratio is less than 8 percent, or leverage ratio is less than 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

between September 30, 1990, and March 31, 1992. The increasing shares of all bank holding companies and bank holding company assets in the stronger capitalization groups are quite impressive. In the beginning of the period, 70 percent of all bank holding companies, possessing only 30 percent of the assets, were classified as well capitalized, but at the end of the period, these percentages rose to 80 percent and 73 percent, respectively. Moreover, 11 percent of the bank holding companies, representing a 28 percent share of the assets, were undercapitalized at the start, and these percentages fell to 7 percent and 5 percent by the end of the period.

Capital ratios have shown strong improvement across the various capital adequacy groups, rising for those that were initially undercapitalized as well as for those that were already well capitalized. Table 3 details the movements of bank holding companies in and out of the three capital zones over the sample period. Here we see that the improved distribution of bank holding companies across capital adequacy groups is only partly explained by mergers and closings. Of the 111 undercapitalized bank holding companies observed at the beginning of the period, 33 left the sample by the end of the period. Another 66 of these institutions became adequately or well capitalized over the same period. The most striking statistic in this table, however, is that 93 of the adequately capitalized bank holding companies (with $881 billion in assets) moved into the well-capitalized group during this short sample period.

Capital adequacy and asset growth
Of the 983 bank holding companies included at both the beginning and the end of our sample, the institutions that were well-capitalized as of September 30, 1990, had asset growth of 15.5 percent, the adequately capitalized grew 9.9 percent, and the undercapitalized shrank 10.6 percent.[15] Much of this differential growth reflects merger activity. Previous studies have noted that well capitalized banks have grown faster than undercapitalized banks over the last few years.[16] These studies implicitly support the view that differences in capital ratios across institutions have more powerful effects on relative asset growth rates in banking than in unregulated financial industries.[17]

[15]Risk-weighted assets grew more slowly, at a rate about 6 percentage points less than asset growth for each capital adequacy group.

[16]See Ronald Johnson, "The Bank Credit 'Crumble,'" this *Quarterly Review*, Summer 1991, pp. 40-51; Cara Lown and Ben Bernanke, "The Credit Crunch," *Brookings Papers on Economic Activity*, 1992:2, pp. 205-39; Joe Peek and Eric Rosengren, "The Capital Crunch in New England," Federal Reserve Bank of Boston *New England Economic Review*, May-June 1992, pp. 21-31; and Herbert Baer and John McElravey, "Capital Adequacy and the Growth of U.S. Banks," Federal Reserve Bank of Chicago, Working Paper Series, no. WP-92-11, June 1992.

[17]Capital strength, however, is also an important determinant of asset growth in unregulated industries. Eli Remolona and Kurt Wulfekuhler have shown that the single most important variable predicting asset

Table 3
Detailed Transitions across Risk-based Capital Groups between 1990-III and 1992-I

	Bank Holding Companies		Assets as of 1990-III	
	Number	Percentage of Total	Billions of Dollars	Percentage of Total
Well capitalized at 1990-III	776	100	1,063	100
Well capitalized at 1992-I	695	90	971	91
Adequately capitalized at 1992-I	29	4	57	5
Undercapitalized at 1992-I	4	1	4	0
Exited sample by 1992-I	48	6	30	3
Adequately capitalized at 1990-III	195	100	1,185	100
Well capitalized at 1992-I	93	48	881	74
Adequately capitalized at 1992-I	63	32	154	13
Undercapitalized at 1992-I	21	11	54	5
Exited sample by 1992-I	18	9	96	8
Undercapitalized at 1990-III	111	100	755	100
Well capitalized at 1992-I	34	31	85	11
Adequately capitalized at 1992-I	32	29	430	57
Undercapitalized at 1992-I	12	11	128	17
Exited sample by 1992-I	33	30	112	15

Notes: Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if their tier 1 risk-based capital ratios are above 6 percent, total risk-based capital ratios are above 10 percent, and leverage ratios are above 5 percent; 2) undercapitalized if their tier 1 risk-based capital ratios are below 4 percent, total risk-based capital ratios are below 8 percent, or leverage ratios are below 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

To measure the independent impact of regulatory capital requirements on relative asset growth, we estimated regressions relating asset growth to tier 1 risk-based capital ratios and public bond ratings.[18] We collected a sample of eighty-eight bank holding companies assigned senior debt ratings by Moody's or Standard and Poor's. (When senior debt ratings were unavailable, they were inferred from subordinated debt ratings.) A second sample was created from the first by dropping nine bank holding companies whose assets grew substantially through mergers during the sample period.

The results, presented in Table 4, show that capital adequacy has an independent effect on asset growth. Both initial capital ratios and bond ratings appear strongly correlated with asset growth, particularly when the large acquirers are excluded from the sample. Moreover, although credit ratings and capital ratios are themselves correlated (the magnitude of each estimated coefficient declines when the other regressor is added to the specification), they have independent strong effects on asset growth. The specifications also include

[18]Results obtained from regressions using other measures of capital adequacy were not significantly different from those reported here.

as regressors *changes* in the capital ratios and credit ratings over the sample period. When both capital ratios and credit ratings are included in the regressions, the change in credit ratings has a positive and significant partial correlation with asset growth, but the change in the capital ratio is not significant. These results are consistent with the idea that initial financial strength, rather than subsequent performance, is the key determinant of near-term asset growth. Since rating agencies are often slow to adjust ratings to new information, credit rating downgrades during the sample period may have been associated with weak asset growth because they were anticipated by the affected bank holding companies.[19]

Which are more constraining: risk-based ratios or leverage ratio requirements?

In aggregate data, we observed a larger improvement in the risk-based capital ratios than in the leverage ratio. To understand what type of regulatory pressure has been most effective in prompting bank holding companies to increase their capital strength, we compared the difficulty of meeting the different capital requirements. In practice, the three ratios are highly correlated: bank holding companies that have high (low) risk-based cap-

[19]For example, during the sample period, the average credit rating fell, although by the end of the period, the average capital ratio had risen.

Table 4

Relationships among Asset Growth, Capital Ratios, and Bond Ratings

Dependent variable: bank holding company asset growth

Explanatory Variables	Sample 1			Sample 2		
Constant term	3.70** (10.13)	−22.73** (7.25)	29.15** (5.94)	−8.58 (6.17)	−32.88** (4.77)	22.56** (4.66)
Initial tier 1 risk-based ratio	2.75** (0.86)	3.33** (0.89)		3.84** (0.51)	4.35** (0.58)	
Change in tier 1 risk-based ratio	1.35 (1.63)	4.03** (1.45)		−0.23 (1.01)	2.42** (0.98)	
Initial senior bond rating	2.14** (0.69)		2.42** (0.70)	1.92** (0.43)		2.09** (0.54)
Increase in senior bond rating	2.83* (1.26)		3.94** (1.11)	2.76** (0.75)		3.54** (0.82)
R^2	0.30	0.20	0.22	0.60	0.50	0.30
Number of observations	88	88	88	79	79	79

Notes: Standard errors are given in parentheses below the coefficient estimates. Bond ratings were converted to numerical values; high ratings correspond to large numbers. Moody's bond ratings were used in most cases. When Moody's ratings were not available, Standard and Poor's were used. In some cases, senior debt ratings were inferred from subordinated debt ratings. Sample 1 consists of eighty-eight bank holding companies with debt ratings by Moody's or Standard and Poor's. Sample 2 consists of seventy-nine bank holding companies with debt ratings by Moody's or Standard and Poor's that did not acquire a large bank holding company between September 30, 1990, and March 31, 1992. Changes in asset growth, risk-based ratios, and bond ratings occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.
**Significantly different from zero at the 1 percent level.

ital ratios tend to have high (low) leverage ratios.

Comparisons between the risk-based and leverage capital requirements are complicated because the minimum leverage requirement varies from one depository institution to another. Broadly speaking, however, smaller bank holding companies tend to have higher risk-based capital ratios relative to their leverage ratios than do larger bank holding companies for two reasons: 1) the small bank holding companies rely more on low-risk security holdings as a source of liquidity, and 2) large bank holding companies typically have more off-balance-sheet exposures. Small bank holding companies tend to satisfy their total risk-based capital requirement with tier 1 capital and loan loss reserves because the issuance of supplemental capital instruments such as subordinated debt or convertible bonds generally involves large fixed costs.[20]

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[20]Although the supplemental capital components of tier 2 capital are valued by the regulators (since they serve as a buffer preventing losses to the deposit insurance fund), market participants report that the credit rating agencies measure capital adequacy almost exclusively by tier 1 capital because the agencies are concerned with the likelihood of default on all debt instruments.

Some observers have argued that, in practice, the leverage requirement is more constraining than the risk-based standards. A Federal Reserve Bank of Chicago study shows that asset growth rates of bank holding companies are more correlated with their leverage ratios than with their total risk-based capital ratios.[21] Another study, published by the Federal Reserve Bank of Boston, argues that the leverage requirement has been a particular impediment to loan growth because regulators require higher leverage ratios at troubled institutions to head off large losses to the deposit insurance fund.[22]

In contrast to these studies, the evidence presented in Table 5 suggests that the leverage ratio requirement is slightly less binding than the risk-based standards for most bank holding companies. In the table, the two

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[21]Herbert Baer and John McElravey, "Capital Adequacy and the Growth of U.S. Banks," Federal Reserve Bank of Chicago, Working Paper Series, no. WP-92-11, June 1992.

[22]Richard Syron and Richard Randall, "The Procyclical Application of Bank Capital Requirements," Federal Reserve Bank of Boston, Annual Report 1991.

Table 5

Risk-based Capital versus Leverage Capital Adequacy Groups

	Bank Holding Companies		Assets	
	Number	Percentage of Total	Billions of Dollars	Percentage of Total
As of September 30, 1990				
All bank holding companies	1,082	100	3,003	100
Risk-based capital groups				
Well capitalized	776	72	1,063	35
Adequately capitalized	195	18	1,185	40
Undercapitalized	111	10	755	25
Leverage ratio capital groups				
Well capitalized	927	86	1,723	57
Adequately capitalized	82	7	903	30
Undercapitalized	73	7	376	13
As of March 31, 1992				
All bank holding companies	983	100	2,965	100
Risk-based capital groups				
Well capitalized	800	81	2,205	74
Adequately capitalized	124	13	613	21
Undercapitalized	59	6	147	5
Leverage ratio capital groups				
Well capitalized	877	89	2,432	82
Adequately capitalized	49	5	389	13
Undercapitalized	57	6	144	5

Notes: Sample consists of all bank holding companies filing FR Y-9C reports for 1990-III. Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if tier 1 risk-based capital ratio is greater than 6 percent and total risk-based capital ratio is greater than 10 percent; 2) undercapitalized if tier 1 risk-based capital ratio is less than 4 percent or total risk-based capital ratio is less than 8 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized. Bank holding companies are assigned to capital groups according to their tier 1 leverage ratios as follows: 1) well capitalized if leverage ratio is greater than 5 percent; 2) undercapitalized if leverage ratio is less than 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

standards of capital adequacy produce different distributions of bank holding companies among the three capital adequacy zones. At both the beginning and end of the sample period, the leverage standard appears modestly more generous than the risk-based capital ratio standard. That is, a greater number of bank holding companies, with greater assets, would be classified as undercapitalized if the risk-based capital ratio rather than the leverage ratio were the sole standard.

Two factors help to explain the difference between this finding and the conclusions reached in earlier studies. First, although other studies show that bank holding company asset growth rates are more correlated with leverage ratios than with *total* risk-based capital ratios, they do not examine the ability of variations in *tier 1* risk-based capital ratios to explain differences in asset growth.[23] Second, desired risk-based capital ratios may have increased relative to desired leverage ratios since the adoption of an explicit regulatory definition of a well-capitalized bank. Because the effective minimum leverage ratio requirement in place over the last three years was 4 to 5 percent for most banks, the recent requirement that well-capitalized banks maintain a leverage ratio in excess of 5 percent is relatively easy to achieve. In contrast, the tier 1 and total risk-based capital minimum requirements of 4 percent and 8 percent, respectively, are substantially less than the new well-capitalized standards of 6 percent and 10 percent, respectively.

The results of a recent survey support the view that for most institutions, desired leverage ratios are not more constraining than desired risk-based ratios. In August 1992, fifty-nine large U.S. banks with combined assets of almost $1 trillion were asked to respond to the following question on capital adequacy:

> Taking into account regulatory requirements, expected loan demand, the quality of loans and other assets in your bank's portfolio, and its prospects for earnings and raising new capital, your bank's current risk-based capital ratio and tier 1 leverage ratio could best be described as 1) very comfortable, 2) fairly comfortable, 3) about adequate, 4) fairly tight, or 5) very tight.[24]

The banks' responses are strikingly consistent for the two capital requirements:

Choices	Risk-based Capital Ratio		Leverage Ratio	
	Number of Banks	Percent of Total	Number of Banks	Percent of Total
Very comfortable	28	47.5	28	47.5
Fairly comfortable	23	39.0	23	39.0
About adequate	5	8.5	6	10.2
Fairly tight	0	0.0	1	1.7
Very tight	3	5.1	1	1.7

Thus, banks themselves have professed a very similar degree of comfort with their risk-based capital ratios and their leverage capital ratios.

Stock market rewards for capital ratio improvements

The remainder of this article analyzes how the stock market has reacted to changes in bank holding company capital ratios. We find that bank holding companies that improved their capital ratios experienced above-average stock price appreciations, particularly if they were weakly capitalized at the beginning of the sample and became well capitalized by the end. Assuming that this appreciation reflects more than a stock market response to strong earnings, the question arises, Why has the stock market been rewarding reductions in leverage at this time? We explore this question by considering the theoretical relationship between stock prices and changes in capital structure and by analyzing in detail the correlation between stock prices and capital ratio improvements in our sample. Finally, we examine how stock market rewards have varied with the different strategies employed by bank holding companies to improve their capital ratios.

The theoretical relationship between changes in capital ratios and stock prices
A substantial portion of both theoretical and empirical research in finance is devoted to the relationship between stock prices and firm capital structures. The standard analytical framework begins with an idealized model that excludes taxes, bankruptcy costs, and the agency costs arising from differential information between investors and firm managers. In this setting, managerial decisions regarding changes in capital structure have no effect on stock prices, except that changes in equity due to common stock dividends have a dollar-for-dollar effect on the value of common shares.[25] By contrast, models that incorporate taxes,

[23]Tier 1 risk-based capital ratios are, of course, more highly correlated with leverage ratios than are total risk-based capital ratios. We found very little difference between the choice of the tier 1 risk-based capital ratio and the leverage ratio in regressions (not reported here) relating capital ratios to asset growth rates.

[24]See the "Senior Loan Officer Survey on Bank Lending Practices," Board of Governors of the Federal Reserve System, August 1992.

[25]The pioneering paper in this area is Franco Modigliani and Merton Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review*, vol. 48 (June 1985), pp. 261-97.

bankruptcy costs, and agency costs imply the existence of a theoretically optimal capital ratio for each firm; in this framework, the financial decisions made by managers can affect stock prices.[26] Firms limit their use of debt because the marginal cost of borrowed funds is an increasing function of leverage.

Factors other than taxes, bankruptcy costs, and agency costs may also be important in the determination of the desired capital structure of regulated firms and, in particular, bank holding companies.[27] Banks with liabilities consisting entirely of government-insured deposits have funding costs that are independent of their capital structures. Such institutions might therefore desire to operate at the minimum capital ratios permitted by their regulators. Under these circumstances, an increase in a bank holding company's capital ratio above the required minimum might cause its stock price to decline (unless the decline in leverage was due to a rise in equity from surprisingly strong earnings). In practice, however, bank holding companies are funded in part by uninsured liabilities, so the desire to drive capital ratios down to their regulatory minimums is not absolute.

The finance literature suggests that, other things being equal, changes in capital structure that have not already been anticipated by the market and that move firms toward their optimal capital ratios should lead to stock price appreciations. In fact, however, one cannot predict unambiguously the algebraic sign of the change in stock prices following increases in capital ratios because many firms are likely to be above and many are likely to be below their optimal capital ratios. Moreover, some changes in capital ratios are anticipated by the market, others are not.

The current environment does suggest, however, that capital ratio improvements at bank holding companies might on average be rewarded by the stock market. Following a period of widespread weak earnings that eroded capital in 1989 and 1990, many bank holding companies presumably fell below their desired capital ratios. Yet over the past two years many of these companies have needed a reasonably high capital ratio to take on certain high-return investment projects such as (1) financing future credit expansion, (2) taking advantage of the acquisition opportunities posed by the current period of industry consolidation, (3) entering new business lines requiring regulatory approval, and (4) competing in the growing markets for swaps or credit guarantees, for which strong credit ratings are a prerequisite.[28] In addition, FDICIA, adopted in 1991, contains powerful incentives for banks to become well capitalized through its provisions relating to risk-based deposit insurance premiums, access to brokered deposits, and capital ratio "tripwires" prompting corrective regulatory actions.

The particular strategies employed by bank holding companies to boost their capital ratios may have incidental effects that alter the expected impact on stock prices, as the following examples suggest:

—A rise in the capital ratio due to earnings growth would likely raise stock prices if earnings were stronger than previously expected and if the market did not expect the gains to be reversed by future losses.

—A rise due to a suspension of dividend payouts might depress prices if the change in dividend policy were viewed by the market as a signal of weak future earnings.

—An increase stemming from direct equity issuance would probably depress stock prices, perhaps because earnings would be diluted or because the market would believe that firm managers issued equity only when their stock was overvalued.[29]

—An increase achieved through asset shrinkage might depress prices if the market interpreted this action as a negative signal of future earnings.

The existing literature has little to say about changes in capital structure that occur in the process of growing or shrinking assets because the standard analysis takes the level of assets to be funded as given.

In summary, it appears likely that many bank holding companies were below their target capital ratios in 1990 and 1991. Recent earnings performance was poor and new regulatory incentives were pushing target ratios upward. Hence, on average, increases in capital ratios that were not already anticipated by the market ought to have led to higher stock prices in 1992. The different methods of achieving capital ratio improvements, however, were likely to have been rewarded differently

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[26]For a discussion of the role of taxes in determining the optimal capital structure, see Merton Miller, "Debt and Taxes," *Journal of Finance*, vol. 32 (May 1977), pp. 261-76. The relationship between agency costs and optimal capital structure is developed in Michael Jenson and William Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, vol. 3 (October 1976), pp. 305-60; and in Stewart Myers and Nicholas Majiluf, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," *Journal of Financial Economics*, vol. 13 (June 1984), pp. 187-221.

[27]The determinants of desired capital ratios for bank holding companies and nonfinancial firms are compared in Larry Wall and Pamela Peterson, "Valuation Effects of New Capital Issues by Large Bank Holding Companies," *Journal of Financial Services*, vol. 5 (March 1991), pp. 77-87.

[28]Bank holding companies can engage in these activities through highly rated, well-capitalized subsidiaries, but the need to segregate capital for these purposes reduces its availability to other parts of the organization.

[29]See, for example, Paul Asquith and David Mullins, "Equity Issues and Offering Dilution," *Journal of Financial Economics*, vol. 15 (January-February 1986), pp. 61-89.

by the market. Capital growth through earnings would probably have been the most generously rewarded, since strong current earnings would signal strong future earnings. It is more difficult, however, to predict how the stock market would have responded to other ways of improving capital ratios—reductions in dividend payouts, stock issuance, and asset shrinkage.

Empirical results

The correlation between stock price appreciation and the capital ratio in our sample was strong, and the relationship was the strongest for those institutions that improved their standings as measured by the capital adequacy zones. Chart 2 and Table 6 present stock price data for a sample of 281 bank holding companies, which together accounted for $2.4 trillion in assets as of March 31, 1992.[30] The average stock price appreciation

[30]Bank holding companies that were known to be merger targets by the end of the period are not included in the sample.

Chart 2

Average Stock Price Appreciation and Movement of Bank Holding Companies across Capital Adequacy Groups

Notes: Sample consists of 281 bank holding companies that met the following three criteria: 1) company had filed FR Y-9C reports, including details on risk-weighted assets, on September 30, 1990, and March 31, 1992; 2) company had not been a known merger target before May 15, 1992; 3) company's stock price data were available. Movement in capital adequacy groups occurred between September 30, 1990, and March 31, 1992. Stock price appreciation occurred between September 30, 1990, and May 15, 1992.

between September 30, 1990, and May 15, 1992, was 62 percent.[31] In the table, bank holding companies are divided into categories on the basis of their initial capital adequacy groups and their subsequent record in improving, worsening, or maintaining their group standing over the period.

The stock market clearly rewarded those bank holding companies that substantially improved their capital ratios.[32] As Chart 2 shows, those institutions that improved their capital adequacy standing averaged stock price growth in excess of 100 percent, while those that slipped in ranking averaged slightly negative stock price performance. Table 6 provides additional insights, including the observation that bank holding companies that rose to the well-capitalized group were able to do so while still expanding assets.

Bank holding companies that were initially weakly capitalized were rewarded more by the stock market for capital ratio improvements than were bank holding companies that were initially well capitalized. Table 7 details the correlations between stock price growth and increases in the various capital ratios. A 1 percentage point increase in the tier 1 risk-based capital ratio led to an increase of almost 25 percent in stock prices for weakly capitalized bank holding companies, whereas well-capitalized institutions experienced only a 7 percent increase for the same increase in capital.[33] The stock prices of weakly capitalized bank holding companies also responded more to increases in their total risk-based ratios and their leverage ratios than did well-capitalized institutions. Changes in capital ratios explain much of the variation in stock price appreciation for weakly capitalized bank holding companies but explain little for well-capitalized institutions; the "R-squares" reported in the Table 7 regressions are high for the former and extremely low for the latter.

We examine next whether the stock price response varies with the strategy employed by the bank holding
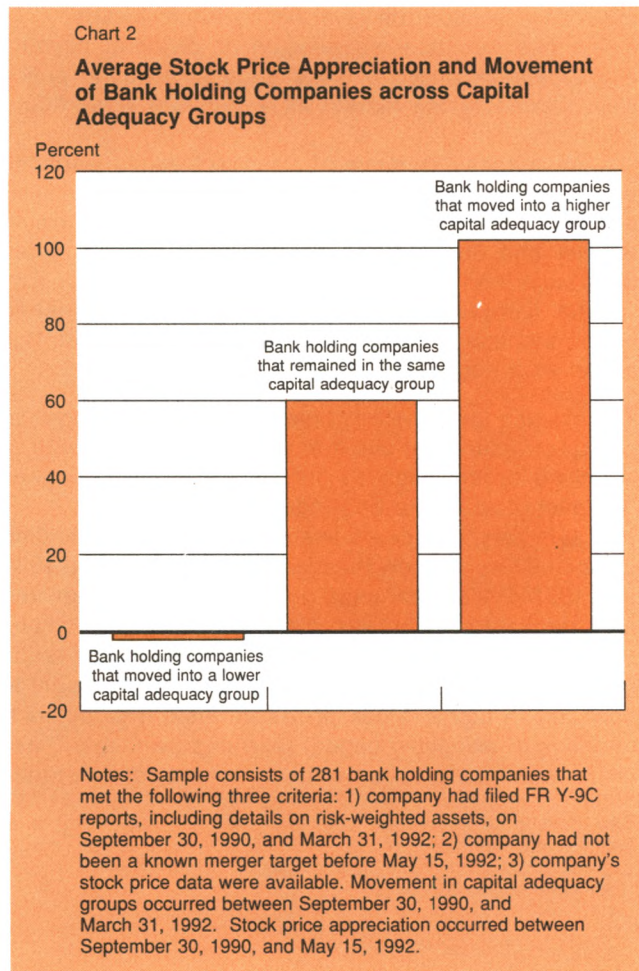
[31]Stock price data were made available to us by the staff of the Board of Governors of the Federal Reserve System. We chose May 15 as the ending date because end-of-quarter financial statements are normally made available to the public within forty-five days.

[32]This statement assumes that causality runs from capital ratio improvement to stock prices, and not vice versa. Although it is not unusual for firms to issue more common stock after large stock price appreciations, that relationship does not appear very strong in our data set. (See the discussion of Table 9 below.)

[33]Many specifications were tried for the regressions reported in Tables 7, 8, and 9. Some of the explanatory variables used—in particular, changes in earnings, growth in loan loss reserves, and growth in nonperforming assets—had coefficient estimates that were economically sensible and significant. The estimated coefficients on capital and assets were, however, not sensitive to the inclusion or exclusion of these additional variables. For ease of exposition, therefore, we have not reported the estimates from these other regressions.

Table 6

Stock Price Appreciation by Capital Adequacy Groups
From September 30, 1990, to May 15, 1992

Capital Group as of 1990-III	Capital Group as of 1992-I	Average Stock Price Growth (Percent)	Number of Bank Holding Companies	Assets as of 1992-I (Billions of Dollars)	Asset Growth From 1990-III to 1992-I† (Percent)
Well capitalized					
	Well capitalized	65	174	694	16.2
	Adequately capitalized	24	14	61	14.8
	Undercapitalized	−45	1	3	−12.7
Adequately capitalized					
	Well capitalized	106	39	887	13.9
	Adequately capitalized	43	22	179	4.3
	Undercapitalized	−31	11	27	−13.5
Undercapitalized					
	Well capitalized	92	5	151	9.4
	Adequately capitalized	92	10	389	−2.3
	Undercapitalized	−35	5	19	−16.3
Totals		62	281	2,410	12.3

Note: Sample consists of 281 bank holding companies that met the following three criteria: 1) company had filed FR Y-9C reports, including risk-weighted assets, on September 30, 1990, and March 31, 1992; 2) company had not been a known merger target before May 15, 1992; and 3) company's stock price data were available. Bank holding companies are assigned to capital groups according to their risk-based capital as follows: 1) well capitalized if their tier 1 risk-based capital ratios are above 6 percent, total risk-based capital ratios are above 10 percent, and leverage ratios are above 5 percent; 2) undercapitalized if their tier 1 risk-based capital ratios are below 4 percent, total risk based capital ratios are below 8 percent, or leverage ratios are below 4 percent; and 3) adequately capitalized if neither well capitalized nor undercapitalized.

†The high average asset growth is due to merger activity.

Table 7

Relationship between Stock Price Appreciation and Changes in Capital Ratios
Dependent variable: bank holding company stock price growth

Explanatory Variables	Sample: Weakly Capitalized Bank Holding Companies			Sample: Well-Capitalized Bank Holding Companies		
Constant term	45.1 (7.0)	40.5 (7.0)	60.5 (6.7)	57.6 (4.4)	58.2 (4.5)	61.3 (4.1)
Change in the tier 1 risk-based ratio	24.5 (3.3)			6.8 (1.8)		
Change in the total risk-based ratio		23.3 (2.9)			5.1 (1.7)	
Change in the leverage ratio			30.3 (4.4)			19.0 (3.5)
R²	0.39	0.41	0.35	0.04	0.04	0.07
Number of observations	92	92	92	189	189	189

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital, ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1992. Changes in capital ratios occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.
**Significantly different from zero at the 1 percent level.

company to improve its capital ratio (Table 8). We first compare the stock price response to an increase in the numerator of the ratio, capital, with the stock price response to a decrease in the denominator, assets. For simplicity, we limit the analysis to factors affecting the tier 1 capital ratio.[34] We then examine whether stock prices respond differently to changes in risk-weighted assets than to changes in total assets. Finally, we decompose the change in capital into its various sources—net earnings, dividends, stock issuance, and equity acquired through mergers.

The estimated coefficients from the regressions reported in the first and third columns of Table 8 reveal the responsiveness of stock prices to growth in tier 1 capital and risk-weighted assets. Both weakly capitalized and well-capitalized bank holding companies experienced large stock price increases as their tier 1 capital rose, although the increase was almost twice as large for the weakly capitalized institutions. The stock price increase following a reduction in risk-weighted assets was also very strong (although slightly less than the increase following a capital increase) for weakly capitalized bank holding companies. Asset shrinkage

was also rewarded, but less strongly, for well-capitalized institutions.

Columns two and four of Table 8 reveal the responsiveness of stock prices to growth in tier 1 capital, risk-weighted assets, and total assets for weakly capitalized and well-capitalized bank holding companies, respectively. For both capital adequacy groups, the estimated response to the capital growth was basically the same as that reported in columns one and three when risk-weighted assets but not total assets were included in the regressions. Moreover, for both groups, the responses of stock prices to total growth in risk-weighted assets and total assets were about equal in size and sum to the coefficients on risk-weighted assets reported in the regressions in columns one and three. It appears that the stock market did not differentiate between reductions in risk-weighted assets and total assets.[35]

Table 9 focuses on the returns to different strategies for increasing tier 1 capital. Regressions for weakly capitalized and well-capitalized firms are presented in columns one and two, respectively. The first regression reported in the upper half of the table relates stock

[34]We also compared the stock market responses to growth in risk-weighted assets and growth in total assets and found no material differences; therefore, the analysis applies to the leverage ratio as well as the tier 1 risk-based ratio. Furthermore, we did not uncover any systematic relationships in the data between stock prices and growth in the supplemental capital components included in tier 2 capital.

[35]We feared that merger activity might be driving some of these results since acquirers were likely to experience large increases in capital, total assets, and risk-weighted assets. We therefore reran the regressions underlying Table 7 after dropping the fifty-nine bank holding companies that reported merger activity in their equity flows. We found no significant differences in the results.

Table 8

Relationship between Stock Price Appreciation and Growth Rates of Capital and Assets
Dependent variable: bank holding company stock price growth

Explanatory Variables	Sample: Weakly Capitalized Bank Holding Companies		Sample: Well-Capitalized Bank Holding Companies	
Constant term	41.78** (7.76)	49.33** (3.21)	50.96** (4.94)	58.21** (5.17)
Growth in tier 1 risk-based capital	2.38** (0.37)	2.71** (0.35)	1.29** (0.26)	1.50** (0.30)
Growth in risk-weighted assets	−2.02** (0.49)	−1.07 (0.67)	−0.57* (0.26)	−0.36 (0.26)
Growth in total assets		−1.39* (0.69)		−0.44 (0.31)
R^2	0.35	0.38	0.11	0.12
Number of observations	92	92	189	189

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital, ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1992. Growth in capital and assets occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.
**Significantly different from zero at the 1 percent level.

price appreciation to risk-weighted asset growth and two variables that in combination sum to tier 1 capital growth—that is, tier 1 capital growth due to net earnings (less preferred stock dividends) and all other sources of tier 1 capital growth. The estimated coefficient on capital growth through earnings was large and significant for both groups. Other contributions to capital growth were also rewarded by the market, but the absolute magnitude of the stock price response was considerably less than the response to earnings for both groups. The stock market responded more favorably to strong earnings (and negatively to weak earnings) because earnings not only raised current capital levels but may also have signaled long-run improvements in profitability.

In the second regression reported in the lower part of the table, the growth in tier 1 capital is further decomposed. Here we see that the stock market responded positively to efforts by both groups to build capital through stock issuance and dividend cutbacks, although rewards were somewhat greater for well-capitalized bank holding companies than weakly capitalized institutions. In addition, for both groups, capital growth through mergers was positively correlated with stock prices.

Table 9

Relationships between Stock Price Appreciation and Growth Rates of Assets and Capital Components

Dependent variable: bank holding company stock price growth

Explanatory Variables	Sample: Weakly Capitalized Bank Holding Companies	Sample: Well-Capitalized Bank Holding Companies
Regression		
Constant term	47.67** (8.83)	37.48** (5.96)
Contribution to tier 1 capital growth from net earnings after preferred dividends	2.19** (0.27)	1.50** (0.27)
Contributions to tier 1 capital growth from all other factors	0.50* (0.26)	0.36 (0.23)
Growth in risk-weighted assets	−1.51** (0.46)	−0.44* (0.22)
R^2	0.45	0.16
Regression		
Constant term	53.30** (12.45)	53.64** (8.97)
Contribution to tier 1 capital growth from net earnings after preferred dividends	2.36** (0.34)	1.89** (0.31)
Contribution to tier 1 capital growth from common stock issuance	0.38 (0.30)	0.58* (0.29)
Tier 1 capital growth from preferred stock issuance	1.12 (0.73)	0.97 (0.90)
Contribution to tier 1 capital growth from common stock dividends	−1.32 (2.09)	−3.22* (1.48)
Contribution to tier 1 capital growth from business combinations (mergers)	1.01* (0.52)	1.02* (0.53)
Growth in risk-weighted assets	−1.60** (0.48)	−0.55** (0.24)
R^2	0.46	0.18
Number of observations	92	189

Notes: All variables are measured in percentage points. All coefficient estimates are significantly different from zero at the 1 percent level (standard errors are given in parentheses). The weakly capitalized sample comprises undercapitalized institutions (tier 1 risk-based capital, ratios below 4 percent, total risk-based capital ratios below 8 percent, or leverage ratios below 4 percent) and adequately capitalized institutions (defined as neither well capitalized nor undercapitalized). The well-capitalized sample comprises institutions with tier 1 risk-based capital ratios above 6 percent, total risk-based capital ratios above 10 percent, and leverage ratios above 5 percent. The capitalization groups are based on capital ratios as of September 30, 1990. Stock price growth occurred between September 30, 1990, and May 15, 1990. Growth in capital components and assets occurred between September 30, 1990, and March 31, 1992.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

Conclusion

The strength of the U.S. banking system has been improving as bank holding companies strive to become well capitalized. Regulatory pressure has probably been the principal force propelling these efforts, but private incentives have also played a role. Bank holding companies, motivated in part by the strategic business opportunities available to institutions with capital to invest, have been moving to repair their balance sheets following a period of weak earnings. The markets have clearly rewarded reductions in leverage, but the preference for higher capital ratios is not without limit: the rewards for capital ratio improvements are significantly less for bank holding companies that are already well capitalized than for weakly capitalized institutions.

The stock market has assigned different rewards to the different strategies employed to improve capital ratios. For well-capitalized institutions, stock price increases were proportionately larger for increases in capital than for shrinkage in assets. For weakly capitalized institutions, however, the stock market made little distinction between the capital ratio improvements achieved through capital growth and the improvements achieved through asset reduction. For all institutions, the price responses to reductions in risk-weighted assets and reductions in total assets were about the same, perhaps because the leverage ratio and risk-based capital ratios appear to be about equally constraining for most bank holding companies. Of the means of raising capital, increased earnings yielded the largest stock price increases. Dividend retention and stock issuance, methods of raising capital that financial officers often fear will depress stock prices, were in fact correlated in our sample with stock price increases. This finding underscores the market's enthusiasm for all forms of capital ratio improvement in recent quarters.

Reserve Requirements and the Discount Window in Recent Decades

by Ann-Marie Meulendyke

Most students of money and banking in the United States would identify open market operations, reserve requirements, and the discount rate as the basic tools of monetary policy. They would add that open market operations are the primary, most actively employed tool because of their flexibility and ease of use. Nonetheless, the other tools also play vital supportive roles in the policy process.

The historical roles of open market operations in the conduct of monetary policy were examined in some detail in an earlier article by the author.[1] This article provides parallel treatment for reserve requirements and the discount window. Both articles focus on the years since the 1951 Treasury-Federal Reserve Accord, an agreement that freed the Federal Reserve from the obligation to peg interest rates on U.S. Treasury debt and enabled it to resume an independent monetary policy.

Review of open market procedures

Because of the interrelationships among the policy tools, it may be helpful to summarize the earlier article's findings on open market operations before beginning the review of reserve requirements and the discount window. Since the Accord, the Federal Open Market Committee (FOMC) has used various money and credit measures, as well as assessments of the underlying economic and price picture, as intermediate objectives

to guide the settings of its operating instruments. Reserve measures and interest rates have alternated as the FOMC's primary guide for day-to-day operations.

In the first two decades after the Accord, the Trading Desk at the New York Federal Reserve Bank carried out the FOMC's instructions for achieving the desired average behavior of various measures of bank credit. Operating decisions were keyed to free reserves—reserves in excess of those needed to meet reserve requirements less reserves borrowed at the discount window—and to the tone and feel of the money markets. By the 1970s, the monetary aggregates had replaced credit measures as intermediate targets and the day-to-day emphasis shifted toward controlling the overnight interbank rate, called the federal funds rate.

During the 1970s, adjustments to the federal funds rate were generally small, and at times there was a reluctance to make necessary increases in the rate. Partly as a result, money growth persistently exceeded its targets, and inflationary pressures reached clearly unacceptable levels by the latter part of the decade. In 1979, the FOMC changed its approach to policy. Under the new procedures, it targeted levels of nonborrowed reserves, a measure that was closely linked through reserve requirement ratios to desired growth rates of a narrowly defined measure of money, M1. In addition, it allowed the federal funds rate to move over a much wider range than before to increase the likelihood that money growth would be brought under control. Although these procedures contributed to increased fluctuations in both money and interest rates, they did help to bring down average money growth and inflation.

At the same time, however, the creation of money

[1]Ann-Marie Meulendyke, "A Review of Federal Reserve Policy Targets and Operating Guides in Recent Decades," Intermediate Targets and Indicators for Monetary Policy: A Critical Survey, Federal Reserve Bank of New York, July 1990, pp. 452-73. Reprinted from this Review vol. 13, no. 3 (Autumn 1988), pp. 6-17.

substitutes and the deregulation of interest rates were making M1 a less reliable guide to future behavior of economic activity and prices. Consequently, the FOMC moved away from these procedures late in 1982. It adopted a borrowed reserve procedure in 1983 that resembled the free reserve technique of the 1960s. The degree of reserve pressure—defined as the volume of reserves that banks as a group were forced to borrow at the discount window—was adjusted judgmentally when developments in the economy, money, or prices suggested that a change was appropriate. Over time, the borrowing relationship that underpinned this approach has become less dependable. Consequently, the Desk has once again come to rely more closely on the behavior of the federal funds rate, although the rate has not become a formal target.

Reserve requirements

This section reviews the various roles of reserve requirements in the monetary policy process. It describes how the monetary authorities, charged with determining appropriate reserve requirements, have responded to the distinct and sometimes conflicting interests of the Federal Reserve, the banks, and the Treasury.

Particular attention is given to the different parties' views of the optimal level of reserve requirements. Historically, banks have sought to minimize reserve requirements. Because the reserves that banks must hold against their deposits do not pay interest, the requirements act as an implicit tax on deposit creation. By contrast, the Treasury has sometimes resisted efforts to lower requirements because reserves provide it with an indirect source of revenue.

The Federal Reserve, approaching the issue from a somewhat different perspective than either the Treasury or the banks, has viewed requirements as a mechanism that can help to stabilize the demand for reserves. It has sought to make them high enough to promote that stability but low enough to minimize the distortions in resource allocation that inevitably accompany any tax.

The Board's most recent cuts in requirements were intended to reduce the implicit tax on banking. The lowered requirements reduced the effective tax to less than $1 billion (see box). The change helped depositories improve earnings and deal more effectively with both strains on their capital and dramatically increased insurance premia. But while these effects were beneficial, the recent reductions also brought required reserves to levels that no longer met many banks' reserve needs for clearing purposes. Consequently, the total demand for reserves became more difficult to predict, and the use of open market operations became more complicated.

The history of reserve requirements since the 1951 Accord encompasses numerous regulatory changes and legislative initiatives that dealt with these conflicting interests. Effective required reserve ratios have been cut substantially on balance over the years, both to reduce the distorting impact of the implicit tax on the behavior of banks and their customers and to change reserve pressures. Required reserve levels since the Accord are shown in Chart 1. Required reserve balances at the Federal Reserve are currently very similar in level to those of the early 1950s despite the massive growth in deposits over the intervening decades.

The roles of reserve requirements

Over the years, analysts have attributed several different roles to reserve requirements in the policy process. The literature since World War II has most commonly cited two—money control and revenues for the Treasury.[2] Reserve requirements could affect the process of monetary control both by their existence and through changes in the mandated ratios of reserves to deposits. The existence of requirements increases the stability in the banking system's demand for reserves. It also provides the linkage that allows changes in reserve levels, accomplished through open market operations, to encourage a change in monetary deposits. In theory, in a system where required reserves are a specified fraction of deposits, an increase in the amount of reserves provided to the banking system should be associated with an increase in reservable deposits in an amount that is a multiple of the reserve increase. The size of the multiple would be the inverse of the required reserve ratio, as in the classic textbook reserve multiplier process. In practice, the relationships linking reserves and deposits are far from precise, partly because not all deposits are subject to the same reserve requirement ratios and partly because excess and borrowed reserve levels can vary.

The primary direction of causality linking deposits and reserves will depend upon the Federal Reserve's guidelines for reserve provision. Regardless of its operating procedures, the Fed has found the existence of reserve requirements to be a valuable tool of monetary policy because of its contribution to creating a stable demand for reserves.[3] A number of observers have argued that reserve requirements are not essential

[2]See Marvin Goodfriend and Monica Hargraves, "A Historical Assessment of the Rationales and Functions of Reserve Requirements," Federal Reserve Bank of Richmond *Review*, March-April 1983, for an excellent review of the rationales for reserve requirements.

[3]Gordon H. Sellon, Jr., discusses this issue in "The Instruments of Monetary Policy," Federal Reserve Bank of Kansas City *Economic Review*, May 1984, pp. 3-20.

because banks would demand reserves in any case to settle transactions with other banks and to avoid overdrafts.[4] Many Federal Reserve commentators have rejected this claim, contending that the voluntary demand for reserves would probably not be stable in the absence of requirements because the banks would always be trying to minimize excess reserves but would have varying degrees of success depending on each

period's reserve flows.[5]

The Board of Governors of the Federal Reserve System may also change reserve requirement ratios to influence monetary policy. To force a contraction in deposits, the Board can raise requirements; to encourage more expansion, it can lower requirements. Although such measures may accomplish desired adjustments in reserve availability, they tend to be a blunt instrument, not well suited to fine tuning. The Federal Reserve discovered that problem in the 1930s, when legislation first gave it the power to change reserve requirements. In recent decades, it has generally used open market operations to cushion the imme-

[4]For examples, see Deane Carson, "Is the Federal Reserve System Really Necessary?" *Journal of Finance*, vol. 19, no. 4 (December 1964), pp. 652-61; and Robert E. Hall, "A Free Market Policy to Stabilize the Purchasing Power of the Dollar," in Barry Seigel, ed., *Money in Crisis: The Federal Reserve, The Economy, and Monetary Reform*, Pacific Studies in Public Policy (Cambridge, Massachusetts: Ballinger, 1984), pp. 303-21. Thomas Mayer, *Monetary Policy in the United States* (New York: Random House, 1968), pp. 39-43, discusses the theoretical arguments against requirements but concludes that they are useful, giving reasons similar to those cited in the text.

[5]Richard D. Porter and Kenneth J. Kopecky, "The Role of Reserve Requirements as a Public Policy Tool," *Conference on Reserve Requirements and the Role of the Federal Reserve System*, Washington, D.C., January 18-19, 1979.

Box

The effective tax on reserve requirements is sensitive to the level of both required reserves and interest rates. Consequently, the tax has been subject to substantial variation over time.

The tax can be measured as reserves times the interest forgone on those reserves. The best interest rate to use is the federal funds rate less any interest paid on reserves (zero in the United States). Determination of the appropriate reserve measure is less straightforward. It probably makes the most sense to include only those reserves that would *not* be held if reserve requirements did not exist. Vault cash is held primarily for general business purposes rather than to meet reserve require-

ments, and should therefore probably be excluded. On these grounds, some portion of reserve balances should also be excluded since they are held to settle transactions with other banks. It is hard to know where to draw the line on what to exclude, however, so rough estimates of the tax have been made using the full amount of required reserve balances at the Federal Reserve. (June figures were used for selected years since reserve requirements are seasonally high in December.) As the following table indicates, the "real" tax has varied considerably from 1951 to the present but shows a dramatic net decline since 1981.

Estimates of the Cost of Reserve Balances
(In Millions of Dollars)

Date	RR balances	Fed funds rate	"Tax"	Tax in current dollars[†]
1951	18,480	1.50[‡]	280	1,520
1961	15,960	1.73	280	1,320
1971	24,660	4.91	1,210	4,180
1981	26,290	19.10	5,020	7,770
1984	19,440	11.06	2,150	2,900
1990	33,100	8.29	2,740	2,960
1991	22,680	5.90	1,340	1,380
1992	20,310	3.76	760	760

[†]Deflated by the CPI for all urban consumers, all items.

[‡]For 1951, the rate shown is the three-month new Treasury bill rate.

diate impact of a reserve requirement change.

Analysts since the Second World War have also focused on the role of reserve requirements in providing revenues to the Treasury through the implicit tax on deposit creation. Required reserves on which no interest is paid reduce bank earnings—at least to the extent that the level of reserves exceeds what banks would hold voluntarily. They enhance the revenues of the Federal Reserve because the Fed buys interest-bearing Treasury debt when it supplies the reserves. The Treasury benefits because the Federal Reserve turns its profits over to the Treasury. How burdensome a given level of requirements will be for banks depends on several factors, but especially on the level of nominal interest rates: the higher the rates, the greater the earnings forgone. Mindful of the tax effects of increasing reserve requirement ratios, the Federal Reserve has often turned to other tools when it wanted to tighten policy.
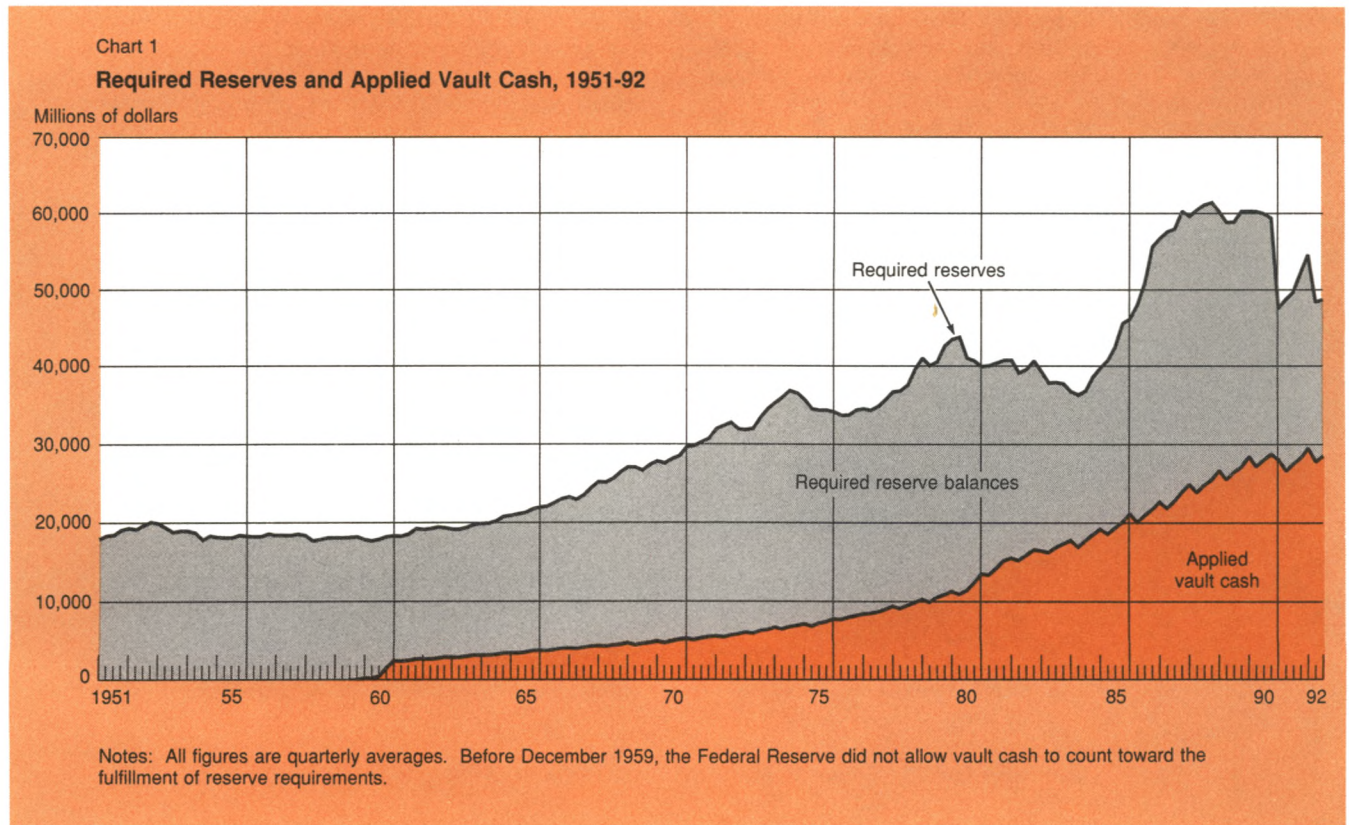
Policy responses to conflicts between Treasury revenues and money control

Federal Reserve and government policies toward reserve requirements from the end of World War II through 1980 were significantly influenced by ongoing strains arising from the different reserve objectives of the government, the Federal Reserve, and the banks. Membership in the Federal Reserve was voluntary for state-chartered banks, so they could escape the reserve tax by dropping their membership. (State requirements were lower and generally could be met by maintaining balances at other banks, for which services were provided, and sometimes by holding Treasury bills, which paid interest.) The Federal Reserve wanted reserve requirements to be broad based enough to facilitate money control.[6] The Fed believed that reserve requirements could be set in a way that would strengthen the linkages between reserves and money and between reserves and short-term interest rates. The existing structure encouraged departures from Federal Reserve membership that weakened those linkages.

The Federal Reserve proposed two solutions to this conflict during the 1970s. First, it called for universal membership so that all banks would be subject to the

[6]G. William Miller, "Proposals on Financial Institution Reserve Requirements and Related Issues," testimony before the House Committee on Banking, Finance and Urban Affairs, July 27, 1978.

Chart 1

Required Reserves and Applied Vault Cash, 1951-92

Notes: All figures are quarterly averages. Before December 1959, the Federal Reserve did not allow vault cash to count toward the fulfillment of reserve requirements.

Fed's reserve requirements. Second, it proposed paying interest on required reserves to offset the banks' revenue loss and to make membership in the Federal Reserve System attractive.[7] The generally high nominal interest rates prevailing during the 1970s made requirements particularly onerous and increased the incentive to surrender membership. Negotiations to address these issues culminated in the Monetary Control Act of 1980 (MCA). The act extended reserve requirements to all depository institutions while allowing membership to remain voluntary. It also lowered required reserve ratios to reduce the implicit tax on member banks.

Although the lower requirements helped to ease the effective tax on banks, the reduction was offset by the exceptionally high interest rates that prevailed in the early years of the 1980s. These rates raised the implicit tax, reducing potential earnings of many depositories and constraining their ability to pay competitive rates. Wide spreads between market rates and deposit rates encouraged depositors to move funds into instruments exempt from reserve requirements. The Federal Reserve continued to ask for the right to pay interest on required reserve balances (in conjunction with allowing interest on demand deposits) but its appeals were not successful.[8] During the eight-year phase-in period for the new reserve requirement structure mandated by the MCA, there were only minimal changes to reserve requirements beyond those specified in the act.

The role of requirements in money control was especially important between 1979 and 1982 when the Fed was seeking to control M1 by adjusting nonborrowed reserves.[9] Thereafter, as the Fed moved away from M1 control, the reserve-M1 linkage received less attention. Nevertheless, even now the linkage is used to forecast required reserves and banks' demand for reserves.

The role of required reserves in bank liquidity
In the nineteenth and early twentieth centuries, most analysts believed that an important function of required reserves was providing liquidity to the banks. Most postwar commentary on reserve requirements has, however, downplayed the idea. Many writers have

pointed out that if banks have to hold reserves to meet requirements, they cannot simultaneously use those reserves to make loans or handle unexpected withdrawals.[10] That conclusion is almost certainly appropriate when the object is to provide liquidity over time.

Nonetheless, reserve balances do provide a very important form of liquidity for periods shorter than the time interval over which requirements must be met on average (one or two weeks in recent decades). These balances constitute a clearing mechanism for interbank check and wire transfers. Far from being sterile balances sitting idly at the Federal Reserve, as they are described in many textbooks, reserves actually flow from one depository institution's account to another's many times a day.

The short-run liquidity role of reserve requirements garnered some attention within the Federal Reserve during the 1980s. At that time, the Fed was seeking an explanation for observed increases in excess reserves.[11] Understanding the importance of the Fed's findings requires a brief review of the composition and uses of required reserves.[12]

Since 1959, banks have been able to satisfy reserve requirements by holding vault cash and/or reserve balances at the Federal Reserve. Beginning in 1968, the vault cash applied to meeting reserve requirements in the current period was the vault cash banks had held in an earlier period. Consequently, vault cash could not play a role in meeting the banking system's marginal reserve requirements once a reserve maintenance period began. Since the reserve requirement restructuring of the 1980s, many depository institutions, including small commercial banks, thrifts, and credit unions, have been able to meet their reserve requirement with vault cash alone. It does not appear, however, that the requirements determine the institutions' holdings of vault cash; instead, these institutions base their holdings on anticipated customer demands for currency and a strong preference not to be embarrassed by short-

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[7]Both the Federal Reserve's proposals for legislation and some alternative proposals appear in Miller, "Proposals on Financial Institution Reserve Requirements."

[8]See statement by J. Charles Partee before the Subcommittee on Financial Institutions Supervision, Regulation and Insurance of the House Committee on Banking, Finance and Urban Affairs, October 27, 1983, reported in the *Federal Reserve Bulletin*, November 1983, pp. 850-51.

[9]To improve the linkage between reserves and deposits, the Federal Reserve did switch from lagged reserve accounting to almost-contemporaneous reserve accounting, a change that was announced in 1982 but not put into effect until 1984.

[10]Before the founding of the Federal Reserve, there was no regular mechanism to produce extra reserves to meet seasonal credit needs. Small banks kept part of their reserves in the form of deposits at large banks and used those reserves to meet their seasonal needs. The withdrawal of interbank deposits from the large cities actually extinguished reserves, forcing interest rates to climb sharply higher at those times. These liquidity problems have been widely discussed. See, for instance, Thomas Mayer, James S. Duesenberry, and Robert Z. Aliber, *Money, Banking, and the Economy*, 3d ed. (New York: W.W. Norton and Company, 1987), pp. 28-29.

[11]The large volumes of daylight overdrafts also alerted the Federal Reserve to some banks' heavy dependence on reserve balances for clearing activities.

[12]The following discussion draws heavily from Ann-Marie Meulendyke, "Monetary Policy Implementation and Reserve Requirements," internal working paper, September 1992, pp. 3-5.

ages of cash. For institutions that consistently meet or more than meet their reserve requirements with vault cash ("nonbound" institutions), reductions in the level of the requirements are of no consequence.[13]

Those medium and large depository institutions that do not cover their whole requirement with vault cash ("bound" institutions) have to hold on average during each reserve maintenance period sufficient reserve balances at the Federal Reserve to meet the remainder of their requirement (called required reserve balances). But those reserve balances also serve as the means of payment for the clearing and settlement process. Any depository that does even a portion of its own clearing
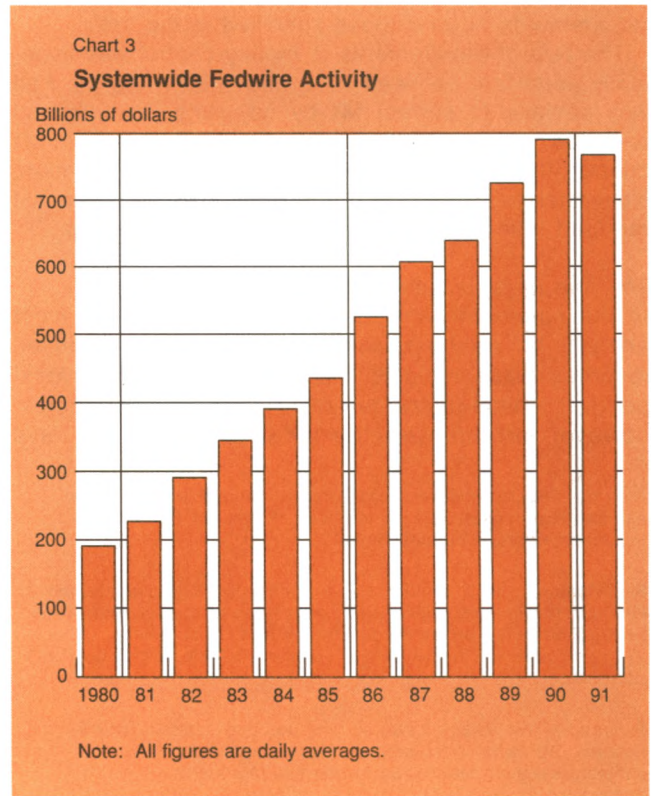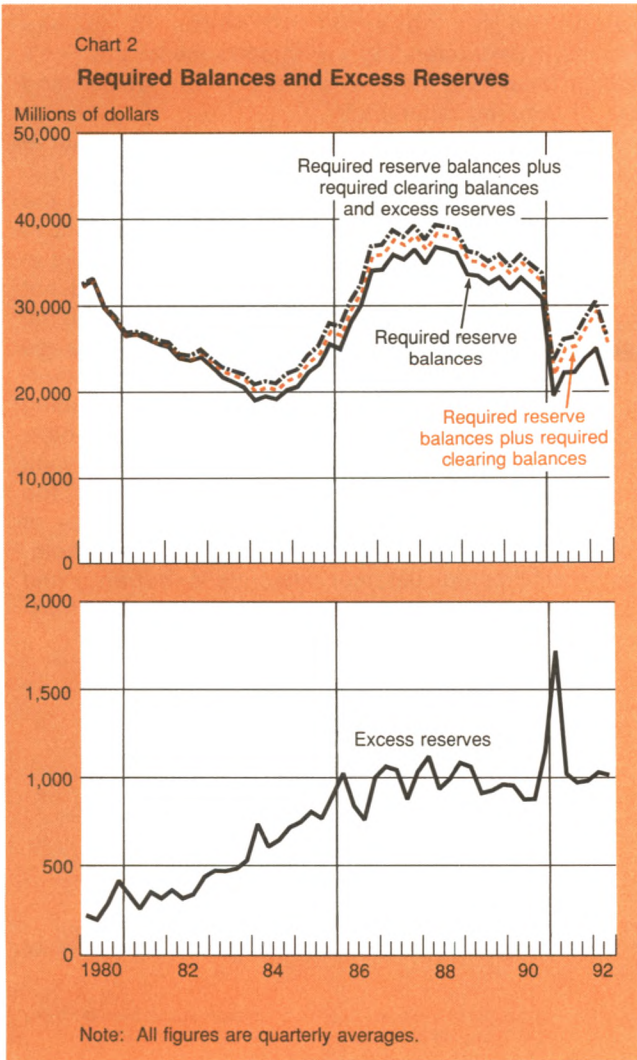
of checks or funds wires has to maintain a reserve balance to facilitate that clearing.

The volume of transactions executed each day using reserve accounts as a means of payment has long been high relative to the balances held in the accounts. For many depositories, reserve balances turn over many times a day. That turnover rate has had an upward trend. The trend reflects cuts in reserve requirements that occurred between 1980 and 1984, and again in 1990 and 1992, and increases in the volume of transactions being processed by the Federal Reserve.[14] Charts 2 and 3 show recent patterns in these measures.[15] The daily flows have a large predictable component, but

[13]The Federal Reserve excludes surplus vault cash from its measures of total and nonborrowed reserves.

[14]Since 1980, depositories have been able to establish required clearing balances to provide some reserve management flexibility. These are additional reserve balances that depositories agree in advance to hold. In return, they receive credits to pay for priced Federal Reserve services. The level of priced services used by a depository provides an effective maximum demand for required clearing balances. Required clearing balances were fairly small until after the 1990 cut in reserve requirements, when many large banks started to hold them.

[15]Fedwire transactions have the largest impact on reserve balances, but other wire transfer operations and check processing transactions also lead to reserve transfers. These other transactions raise the turnover rate for reserve balances even further.

Chart 2
Required Balances and Excess Reserves

Millions of dollars

Required reserve balances plus required clearing balances and excess reserves

Required reserve balances

Required reserve balances plus required clearing balances

Excess reserves

Note: All figures are quarterly averages.

Chart 3
Systemwide Fedwire Activity

Billions of dollars

Note: All figures are daily averages.

considerable potential for surprise remains. The Federal Reserve generally processes instructions to pay out reserve balances even if the action puts the sending bank into overdraft. The Fed imposes a penalty charge on any institution that ends the day overdrawn. Consequently, depository institutions have to aim for a significant positive end-of-day balance to minimize the risk of an inadvertent overdraft, regardless of their reserve requirements.

Depository institutions can deal with these additional precautionary reserve needs by holding excess reserves, but this strategy is costly since no interest is paid on reserves. When required reserve balances declined in the early 1980s and again at the end of 1990, depositories continued to try to minimize excess reserve holdings, but they were restricted in their ability to do so. As noted below, if banks built up a cumulative excess reserve position early in the period, either deliberately or because of an unexpected reserve inflow, they could be unable to work off the excess reserves without risking an overnight overdraft if they experienced a reserve shortfall. In trying to cope with the narrowing ranges of reserve balances that were acceptable in the management of reserves, depositories devoted considerable resources to monitoring internal reserve flows. In the process, they became less tolerant of excess reserves early in maintenance periods because of their diminished ability to work them off in subsequent days. These developments restricted the depositories' day-to-day flexibility in managing reserves, caused more frequent unintended bulges in excess reserves, and added to end-of-day volatility in the federal funds rate.

Reserve requirements in the 1950s and early 1960s
At the time of the Treasury-Federal Reserve Accord of 1951, reserve requirement ratios on demand deposits of Federal Reserve member banks were 24 percent for banks located in "central reserve cities" (New York and Chicago), 20 percent for member banks in "reserve cities" (other cities with Federal Reserve Banks or branches), and 14 percent for "country banks" (the term for all other member banks). The reserve ratio for time and savings deposits was 6 percent for member banks in all locations.

During the fifteen years between 1951 and 1966, requirements were raised on five occasions and were lowered ten times.[16] The changes in reserve require-

ments were sometimes made in conjunction with complementary changes in the discount rate, while at other times the moves were made independently. Open market operations were used to cushion the changes in reserve requirements, so that hardly any of the immediate impact of the reserves released or absorbed was felt as a change in excess or borrowed reserves.

In those years, the Federal Reserve formally described reserve requirements as a policy tool used to make reserves more or less plentiful so as to alter credit availability and money market interest rates—the near-term policy goals of the time.[17] Its decisions about reserve requirements were, in practice, constrained by the exodus of small banks from the Federal Reserve System in the 1950s. Legislation passed in 1959 addressed an apparent inequity between large and small banks in an attempt to make membership more attractive for the small banks. Country banks had lower nominal reserve requirements, but they often had to tie up relatively large sums in non-interest-earning reserve balances that did not serve any other purpose. (A reserve city bank generally handled payment clearing for them.) Because of their customer bases, most country banks had to hold relatively high amounts of vault cash, but they could not use these holdings to satisfy requirements. The 1959 act permitted the Fed to count vault cash toward meeting reserve requirements. That change—implemented in three steps during 1959 and 1960—reduced effective requirements, especially for country banks. It was hoped that the lower requirements would encourage those banks to remain members of the Federal Reserve.

Contemporary views of reserve requirements
A commonly held view about reserve requirements was expressed by a presidential commission appointed in 1963 to study financial institutions. The commission concluded that "there is, within broad limits, little basis for judging that in the long run one level [of reserve requirement ratios] is preferable to another in terms of facilitating monetary policy."[18] The commission felt that the effects of requirements on bank earnings and Treasury revenues should be the primary factor considered in choosing reserve ratios. Although it saw the advan-

Footnote 16 continued
ratios were slightly modified in 1966 when tranches were introduced for both demand and time deposits. At the same time, savings accounts were separated from time deposits for required reserve calculations.

[16]Reserve requirement ratios were changed for several reasons over these years. Although many of the changes were undertaken to make reserves more or less costly as part of the monetary policy process, changes were also made to meet seasonal reserve demands and to implement the 1959 legislation aimed at equalizing reserve ratios at central reserve and reserve city banks. In addition,

[17]Board of Governors of the Federal Reserve System, *Annual Report*, various years.

[18]Report of the Committee on Financial Institutions to the President of the United States. Walter W. Heller, Chairman. Washington, D.C.: Government Printing Office, 1963, p. 12.

tages to bank profitability of a significant cut, it believed that the cost to the Treasury would be too great.

Some academic literature of the time offered other views on reserve requirements and monetary control. Several articles and books dealt with the concept of fractional reserve requirement ratios and described the strengths and weaknesses of that structure. Tolley analyzed the tax implicit in reserve requirements.[19] He suggested that the level of reserve requirement ratios and hence of the amount of the tax had come about by accident. He then tried to establish a rationale for such a tax. He believed that under a gold standard, a system in which real resources had to be devoted to producing money, a fee was appropriate to encourage people to economize on the use of money. But when the cost of producing money is trivial, as it is with fiat money, the only justification for a charge is that the government could benefit from the revenues arising from the Federal Reserve's provision of reserves. Tolley went on to observe, however, that the government's gains would cause misallocation of resources as banks took actions to reduce the effect of the tax. Such a distortion would argue for very low reserve requirements. But Tolley thought very low requirements might make monetary control difficult because shifts between currency (which is effectively subject to a 100 percent reserve requirement) and deposits would have a large impact on the amount of money created, as would mistakes in estimating reserve provision. Hence he recommended that interest be paid on required reserves so that requirements would not need to be reduced.

Friedman also discussed how shifts in preferences between currency and deposit holdings could ease or tighten reserve conditions.[20] He reiterated the arguments from the 1930s for 100 percent reserve requirements. Such requirements had been proposed as a solution to the unpredictable multiplier effects of fractional reserve accounting arising from the differential treatment of deposits and currency. Friedman also recognized the undesirable tax effect of 100 percent requirements and described the inevitable incentive for money and credit provision to move outside the regulated area of banking. To combat that problem, he recommended paying interest on reserves. Later, the Federal Reserve seriously considered the proposal to pay interest on reserves; it has periodically requested authority to do so from the Congress.

Reserve requirements in the latter part of the 1960s and 1970s

Reserve requirements continued to be raised and lowered to reinforce tightening or easing moves implemented with other tools during the rest of the 1960s and 1970s. Requirements were increased four times and decreased seven times during these years.[21] Sensitivity to the membership problem sometimes made the Federal Reserve Board hesitant to raise requirements. On occasion, the Board raised them just on large time deposits—deposits mostly issued by the large banks, which were the least able to give up the services provided by Fed membership. The combination of higher inflation and higher interest rates that emerged during these years drew increasing attention to the tax burden of reserve requirements and the related question of differential treatment of member and nonmember banks.

The Federal Reserve appointed a study group headed by Robert Black to review reserve requirement ratios. The group reported its recommendations in 1966.[22] The primary result of that study was the decision to move from near-contemporaneous reserve requirements with one-week reserve maintenance periods for reserve city banks and two-week periods for country banks to weekly reserve periods for all member banks with a two-week lag between the computation and maintenance periods. This change was believed to make calculating requirements easier for the banks and the New York Fed's Trading Desk.[23]

Lagged reserve requirements weakened the direct linkage between reserves and money, making it harder, in theory, to manipulate reserves as a means of controlling money. For the most part, the Federal Reserve did not see any reason to be concerned because it was not attempting to control money in this way. Instead, the Fed was attempting to affect money growth indirectly by influencing the demand for money. It altered the cost of obtaining reserves and hence the cost at which credit was provided.[24]

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[21]The count does not include the 1972 restructuring that raised requirements for some banks and lowered them for others, as described later in the text.

[22]Robert P. Black, *Report of the Ad Hoc Subcommittee on Reserve Proposals*, May 13, 1966.

[23]The other change was to permit banks to carry forward reserve excesses up to 2 percent of required reserves for one reserve period. (Banks already had the authority to carry forward 2 percent of reserve deficiencies.)

[24]Lyle E. Gramley and Samuel B. Chase, Jr., "Time Deposits in Monetary Analysis," *Federal Reserve Bulletin*, October 1965, pp. 1380-1404.

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[19]George S. Tolley, "Providing for Growth of the Money Supply," *Journal of Political Economy*, December 1957, pp. 477-85.

[20]Milton Friedman, *A Program for Monetary Stability* (New York: Fordham University Press, 1959), pp. 65-76.

In 1972, another Federal Reserve reform addressed the problem of retaining member banks. For both reserve city and country banks, reserve requirement ratios were to be graduated on the same schedule by volume of deposits. The change represented a significant cut in reserve requirements for small banks in Federal Reserve cities and caused some large banks outside of Federal Reserve cities to face higher requirements. The series of graduated steps in the required reserve schedule further weakened the relationship between required reserves and monetary deposits, an outcome that distressed those economists who wanted to see the Federal Reserve control reserves in order to control money growth. At the time, the Federal Reserve was targeting the federal funds rate and reserve requirements were lagged, so the concerns were not immediately relevant to operations.[25]

Nonetheless, Federal Reserve membership continued to decline. The Federal Reserve proposed paying interest on reserves on a couple of occasions in the 1970s to halt the decline, but the revenue loss to the Treasury engendered strong congressional opposition.[26]

The Monetary Control Act and reserve requirements in the 1980s

At the end of the 1970s, the Federal Reserve once again tried to achieve universal membership. Although it did not literally accomplish that, it did achieve, through the 1980 MCA, the most important goal associated with expanded membership: the extension of reserve requirements to all depository institutions. Furthermore, the Fed was permitted to collect deposit data on an ongoing basis from all but the smallest depositories, enabling it to improve both estimates of actual money and forecasts of future money. Reserve requirement ratios for member banks on transactions deposits were cut over a four-year period from a top rate of 16¼ percent to a top rate of 12 percent. A low reserve tranche was also established of 3 percent on the first $25 million of deposits, with the amount of the tranche allowed to rise over time.[27] Nonmember banks and thrifts that faced the increases in requirements were

given an eight-year phase-in period to reach the final levels of requirements specified in the act. The Federal Reserve Board retained the option to adjust reserve ratios within specified bands.

The MCA was directed toward improving the Fed's ability to control money. It focused on deposits in M1, the primary intermediate policy variable at the time. It did not, however, provide any scope for using reserves to control M2, a secondary target at the time the act was passed but the primary monetary target later in the decade. Money market mutual fund balances remained exempt, and the MCA actually took away from the Federal Reserve the power to impose reserve requirements on personal time and savings deposits.

Aside from the changes to reserve requirements mandated by the legislation, only minor modifications were made to reserve requirements during the 1980s.[28] Because the structure of requirements had been set within specified limits by the MCA, it was generally felt that policy-related changes in the ratios would have been difficult to implement during the eight-year phase-in period, so there was little point in considering them. Since the legislation had not given the Federal Reserve the option to pay interest on reserve balances, the Board might have hesitated to raise requirements because of the implied increase in the tax burden.[29] Furthermore, the Federal Reserve believed it could achieve its objectives just as well through open market operations and discount window policy.

Excess reserve behavior and potential problems with reserve requirements

The Federal Reserve saw increasing evidence during the 1980s that depository institutions were having difficulty managing reserves. These observations suggested that reserve requirements might be inadequate for smooth monetary operations. Normal levels of excess reserves rose fairly steadily in the years following passage of the MCA. Some of the increase was the inevitable result of extending reserve requirements to nonmember depository institutions.[30] But member bank

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[25]Nonetheless, shortly afterwards the Federal Reserve did take limited steps to use reserve targeting when it experimented with reserves on private deposits. See Meulendyke, "A Review of Federal Reserve Policy Targets and Operating Guides," pp. 463-64.

[26]Specific proposals to pay interest on reserves were introduced in the Congress in 1977 and 1978. See Stuart E. Weiner, "Payment of Interest on Reserves," Federal Reserve Bank of Kansas City *Economic Review* January 1985, pp. 20-21.

[27]In 1982, the Garn-St Germain Act modified the reserve requirement structure further to introduce a zero requirement tranche.

[28]In March 1983, the Board eliminated reserve requirements on time deposits with an initial maturity of two and one-half years or more. In September 1983, it reduced the minimum maturity for exemption from requirements to eighteen months.

[29]The MCA did provide for payment of interest on supplemental reserve requirements under restricted circumstances if such requirements were needed for monetary control. The provision has not been used.

[30]At some point during the phase-in period, vault cash no longer met all of the larger nonmember institutions' requirements, and they opened reserve accounts at the Federal Reserve. Only then could these institutions have excess reserves. (Previously, they may have had excess reserves from their own perspective in the form of surplus vault cash and deposits at correspondents, but the Federal Reserve does not count these in its reserve measures.)

excess reserves were also rising, in a pattern that contrasted with their behavior during much of the 1970s, when they had generally hovered in a range near $200 million. The search for explanations led to several discoveries. It was observed that excess reserves tended to move inversely to required reserves not met by vault cash, both period to period and over time, as balances held at Federal Reserve Banks trended lower.[31] The sharp drop in required reserve balances between 1980 and 1984 occurred as lower reserve requirements were being phased in for member banks under MCA and the spread of automatic teller machines was encouraging rapid expansion of vault cash holdings (Chart 1).

Average required reserve balances rose again in the next few years, but excess reserves continued to expand at member banks as well as at nonmember banks. Conversations with officials at a number of banks underscored the growing role of large payments flowing through their reserve accounts. The volume of wire transfers over Fedwire—the Federal Reserve's wire transfer system—grew rapidly (Chart 3), making it increasingly difficult for banks to predict reserve balances. Since the Federal Reserve penalized end-of-day overdrafts, banks had to be careful not to aim for too low a reserve balance lest an unexpected late day outflow (or an expected receipt that did not arrive) should leave them overdrawn. These discoveries suggested that for a number of banks, reserve balances needed to meet requirements were not very different in size from those needed to manage clearing and settlement and to avoid overdrafts.

These factors were taken into account by the Federal Reserve in estimating the aggregate demand for excess reserves.[32] But they did not lead to serious discussions of the structure of reserve requirements during the 1980s.

Cuts in reserve requirements in the 1990s
The Federal Reserve Board eliminated reserve requirements on nontransaction deposits at the end of 1990. In explaining its action, the Board indicated that the existing structure had been designed "primarily to permit greater precision of monetary control when policy focused on reserve aggregate targeting." It went on to describe the changing conditions that had prompted its move:

In subsequent years, as the Federal Reserve moved away from the procedures in effect in the early 1980s, which required a broad reserve base, reserve requirements on nonpersonal time accounts have become somewhat of an anachronism. Moreover, the current 3 percent requirement has placed depository institutions at a disadvantage relative to other providers of credit, spawning efforts to circumvent the requirement.

The Board took action at this time also in response to mounting evidence that commercial banks have been tightening their standards of creditworthiness, [a development that] has in recent months begun to exert a contractionary influence on the economy.... Lower reserve requirements at any given level of money market interest rates will reduce costs to depository institutions, providing added incentive to lend to creditworthy borrowers.[33]

The reduction in reserve requirements boosted earnings for some depository institutions but, as indicated earlier, it had the undesirable side effect of complicating reserve management for many institutions. With lower routine levels of required reserve balances, their ability to accept reserve variability from day to day within a two-week reserve maintenance period without either incurring an expensive overdraft or being stuck with unusable excess reserves was reduced. Depositories found they had to use considerable resources to hold down excess reserves. The action also complicated operations of the Open Market Trading Desk at the New York Federal Reserve Bank, especially in the first few months of 1991.[34]

Relatively modest reserve excesses often inspired sharp declines in the federal funds rate, even on days that were not the ends of maintenance periods. Depositories had less ability to absorb and make use of the excess reserves because they could not run large deficiencies in subsequent days without ending overdrawn. When a number of depositories discovered toward the end of a day that they had excess reserve positions and tried to sell the funds into the interbank federal funds market, their efforts often pushed the funds rate down sharply, sometimes almost to zero. At that time of day, it is too late for open market operations to be undertaken to affect that day's reserves, since same day transfers of Treasury debt cannot be arranged after the Fed's securities wire closes, officially at 2:30 p.m. eastern

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[31]David Jones, "Excess Reserves under MCA," November 10, 1983, and David Small and Brian Madigan, "An Analysis of Excess Reserves," July 1, 1986, internal memoranda, Board of Governors of the Federal Reserve System.

[32]Ann-Marie Meulendyke, *U.S. Monetary Policy and Financial Markets*, Federal Reserve Bank of New York, 1990, chap. 6.

[33]*Federal Reserve Bulletin*, February 1991, p. 95.

[34]See "Monetary Policy and Open Market Operations during 1991," this *Review*, Spring 1992, pp. 80-88, for a discussion of these developments and a description of their impact on the Desk's reserve management.

time. Hence, depositories as a group could not eliminate the excesses except by repaying discount window loans. In 1991, routine borrowing from this source was already at very low levels, so little could be repaid.

Low reserve balances also increased the likelihood of an incipient overdraft. Depositories that discovered they were overdrawn late in the day generally tried to cover the overdrafts by borrowing in the federal funds market. If funds were scarce systemwide, sufficient reserves might not be available. Depositories could obtain reserves from the discount window, but in the early months of 1991, many banks were unusually reluctant to borrow lest such a step be read as a sign that they were in trouble. That reluctance to borrow often caused federal funds to be bid to very high levels before some banks finally turned to the window to cover the shortages.[35]

The role of the discount window in policy implementation

Like reserve requirements, the discount window has played a supporting role to open market operations in the monetary policy process. This section describes the guiding principles for discount window borrowing. It reviews the two main features of that borrowing, the rules that govern the use of the facility and the rate or rates that are charged. It then provides a chronological review of developments in the behavior of borrowing from the 1950s to the present.

The philosophy behind the discount window mechanism

Federal Reserve views of the discount window's roles changed considerably between the founding of the Fed-

eral Reserve in 1914 and the 1930s as open market operations gradually replaced discount window borrowing as the primary source of Federal Reserve credit. Then, between 1934 and 1950, the discount window fell into disuse, and there was little consideration of the roles of the window as a policy tool.

The Federal Reserve's concept of the policy role of the discount window was reexamined after the 1951 Accord and again in the latter half of the 1960s. Both studies led to some modifications in the rules for borrowing but did not change the underlying philosophy. Most of the rule changes since the early 1970s have been small and have addressed specific concerns.

Since the Accord, the Federal Reserve's discount window policy has discouraged persistent reliance on borrowing. That stance has ensured that borrowed reserves generally represent only a modest share of total reserves. The Fed believes that the discount window should serve as a safety valve, a temporary source of reserves when they are not readily available from other sources.[36]

The window in recent decades has been available to healthy banks for occasional, but not continuous, use.[37] Borrowing has been rationed through a variety of means that have encouraged a "reluctance to borrow." The degree of reluctance shown by the banks has varied considerably over the years, even in the absence of changes in the guidelines for borrowing.

At the same time, the Fed has counted on there being some amount of borrowing because borrowing is an element in the reserve adjustment process. In this context, the window has played a vital role in meeting unexpected reserve needs. Various open market operating procedures depend on some degree of stability in the banks' demand for borrowed reserves, but the administrative guidelines and changing bank attitudes have made this stability difficult to achieve. For much of the time since the mid-1960s, the discount rate has been below competing market rates, in particular the overnight federal funds rate. Consequently, administrative restrictions rather than the rate have had the biggest role in limiting the amount of borrowing. Banks have responded to the profit incentive to borrow, but in doing so they have had to factor in some nonprice costs—such as potential loss of future access to the window—that are difficult to estimate.

During the 1980s, increasing financial difficulties and

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[35]A series of papers prepared by the staff of the Federal Reserve Bank of New York after the 1990 cut in required reserve ratios considers the operational difficulties of low required reserve ratios and evaluates possible solutions. Overall, the papers suggest that the best solution to the reserve management problems encountered with low reserve balances would be to pay interest on reserves so that requirements could be increased without raising the costs to depository institutions.

The collection of papers also evaluates other alternatives. A return to more routine use of the discount window would provide the banking system with valuable flexibility, but overcoming the current strong reluctance to borrow appears to be a difficult challenge.

In the absence of such changes, only one of the other alternatives could provide more than modest help to the reserve management process: permitting banks to end the day overdrawn. Nonetheless, permitting overdrafts would have significant drawbacks. If this approach were to be seriously considered, permitted overdrafts would have to be collateralized and made subject to a modest charge. Even so, it seems to go against the thrust of efforts to reduce daylight overdrafts and could be seen as weakening the essential discipline of a reserve requirement structure.

Other approaches deserving consideration include expanding reserve carryovers and shortening the vault cash lag, variants of which have recently been introduced by the Board of Governors. These approaches, however, would raise reserve management flexibility only slightly.

[36]All borrowing from the Federal Reserve must be fully collateralized.

[37]At times, the Fed also provides extended credit at market-based rates to banks whose financial difficulties have cut them off from regular sources of financing. Banks using the facility must work with their regulators toward a solution. That type of borrowing is not a monetary policy tool, and thus is not a focus of this piece.

bank failures led banks to become more reluctant to borrow, even under conditions that would formerly have led them to use the window. The rise in banking crises made many banks fearful that if they borrowed, rumors that they were in financial trouble would arise. Thus, the demand for borrowing became even less predictable, reducing the value of the relationship between borrowing and the spread between the federal funds rate and the discount rate that was exploited in the policy process.

The direct cost represented by the rate charged for discount window borrowing has also played some role in the policy process. Changes in the rate have normally attracted general attention to the state of monetary policy, giving rate changes the potential for an announcement effect. The extent of the announcement effect has varied over time, depending on the verbal message given with the rate change and the way borrowing was being used in carrying out policy. Sometimes the Fed has sought to signal policy changes when it changed the rate. At other times it deliberately downplayed the significance of the move.

Changes in the discount rate are voted by the Boards of Directors of the twelve Federal Reserve Banks and approved by the Board of Governors. The governors generally approve changes in the rate when they want to signal a change in the stance of policy or when market rates have moved significantly away from the discount rate, so that the discount rate is "catching up" with the changes. Rate changes have normally complemented the guidelines established by the FOMC for the conduct of open market operations.

The discount rate per se has not, in the post-Accord period, been regarded as a primary means of influencing the amount of discount window borrowing. Indeed, because short-term interest rates have frequently exceeded the discount rate since the mid-1960s, rationing of the use of the window has had to be accomplished through means other than the rate. There have been numerous recommendations over the years that the rate be given the primary role in rationing credit, either because the approach was more straightforward and less arbitrary than rationing administratively or because the use of a below-market rate implied a subsidy. The specifics of the relationship between the discount rate and open market policy changed modestly when the techniques of policy implementation were changed but have consistently relied on administered disincentives to borrow.

The discount window in the 1950s through the mid-1960s

Borrowing jumped dramatically in the early 1950s. It rose from an average of $130 million in 1950 to an average of $800 million in 1952. By December 1952, it had reached $1.6 billion. Interest rates rose after the Accord, and the discount rate lagged behind. (Chart 4 shows borrowed reserves and their share of total reserves between 1950 and 1965, along with the discount rate and short-term interest rates.) The cost structure made borrowing attractive for the first time since the early 1930s. An excess profits tax instituted in 1951 increased the incentive to use the discount window because borrowings served as an offset in computing the tax.

A Federal Reserve System committee was established in 1953 to examine the history of the rationales for borrowing. The committee concluded that the established "tradition against borrowing" should be encouraged because it contributed to the soundness of individual banks and the banking system.[38] The committee report served as the basis of the 1955 revisions to Regulation A, the regulation governing use of the window.[39]

The report observed that the founders of the Federal Reserve had expected the discount window to be the primary source of Federal Reserve credit. In the early years of the Federal Reserve, many member banks borrowed a substantial portion of the reserves they needed from the window; indeed, it was not unusual for a bank to borrow continuously. By contrast, in the years before the founding of the Federal Reserve, a bank that was heavily dependent on borrowed funds, rather than on its own capital and deposits, was believed to be more vulnerable to failure.

The committee noted that the development of open market operations during the 1920s as an alternative source of Federal Reserve credit made possible a gradual move to discourage heavy borrowing. Once again, banks that borrowed persistently came to be seen as more likely to fail, and this view was reinforced during the early 1930s when the number of bank failures soared. Mindful of this negative image, the banks themselves became reluctant to borrow and instead built up holdings of excess reserves during the latter part of the 1930s. This course of action was simplified by the monetization of the vast gold inflows inspired by the revaluation of gold in 1934 and by the approach of war in Europe in the latter years of the decade.[40]

By the early 1950s, however, a decade and a half with low numbers of bank failures had apparently reduced the banks' own reluctance to borrow to such an extent

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[38]System Committee on the Discount and Discount Rate Mechanism, "Report on the Discount Mechanism," March 12, 1954.

[39]*Federal Reserve Bulletin*, January 1955, pp. 8-14.

[40]Meulendyke, *U.S. Monetary Policy and Financial Markets*, chap. 2.

that many banks were inclined to return to the window when doing so became profitable. The committee felt this behavior should be discouraged. It reiterated the belief that a bank that used its own resources to meet increased demands for credit was healthier than one that was dependent on borrowed funds. In its 1954

report, the committee recommended that routine reserve provision be accomplished almost entirely through open market operations. The report also recommended limiting the term of borrowing to fifteen days under normal circumstances. It noted that most banks had emerged from the war with substantial portfolios of

Chart 4

Borrowed Reserves and Selected Interest Rates, 1950-65
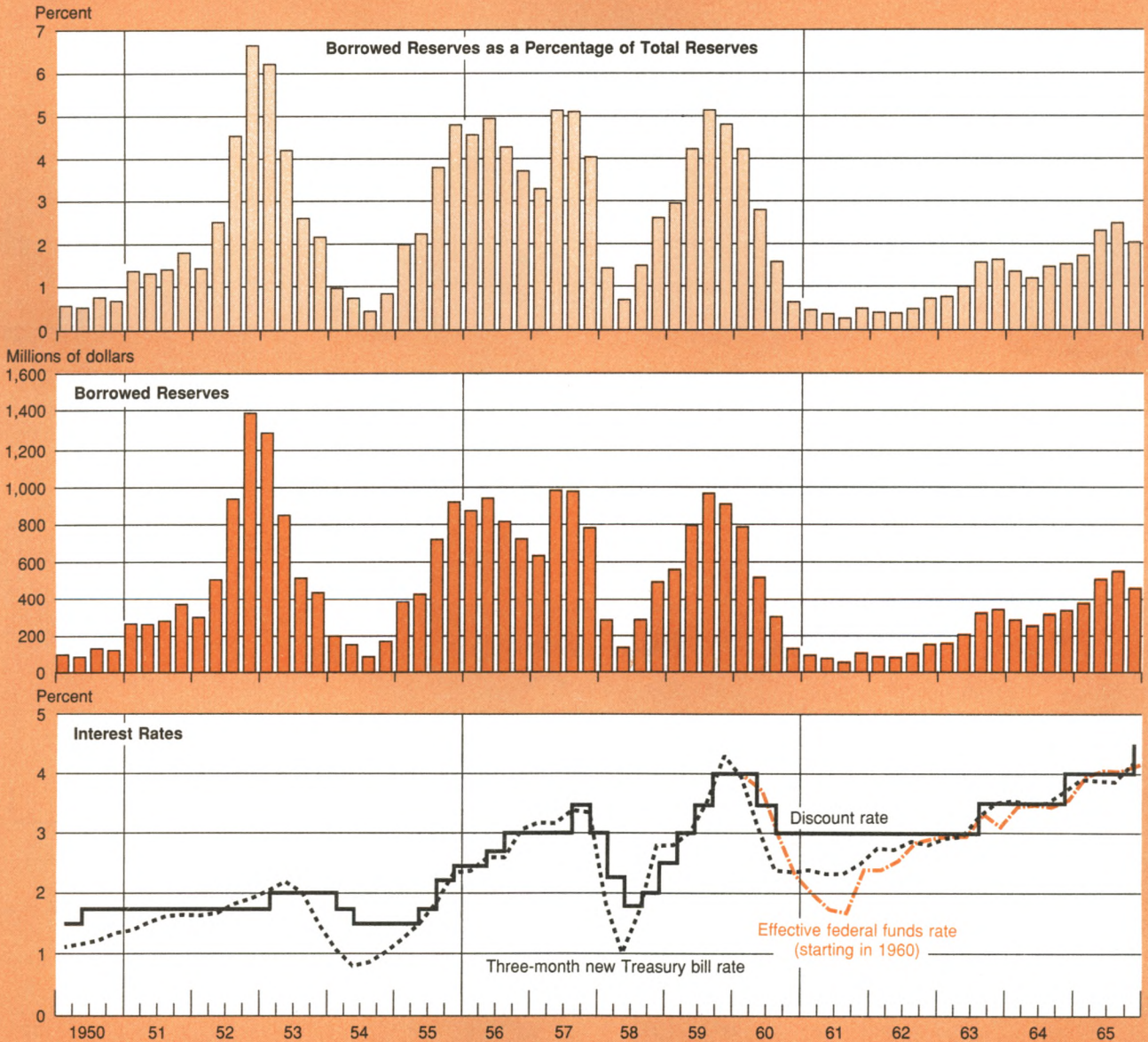
Notes: All figures are quarterly averages except for the discount rate. The discount rate is the rate in effect on the last day of the quarter.

government securities that could be sold to raise additional funds for seasonal or other purposes. The regulations that were subsequently adopted guided discount officers in distinguishing between "appropriate" and "inappropriate" borrowing. Borrowing was considered

inappropriate when the funds were used for normal business activities. In particular, the committee disapproved of borrowing to profit from interest rate differentials.

The role of the discount window during the rest of the

Chart 5
Borrowed Reserves and Selected Interest Rates, 1966-79

Percent

Borrowed Reserves as a Percentage of Total Reserves

Millions of dollars

Borrowed Reserves

Percent

Interest Rates

Effective federal funds rate

Discount rate
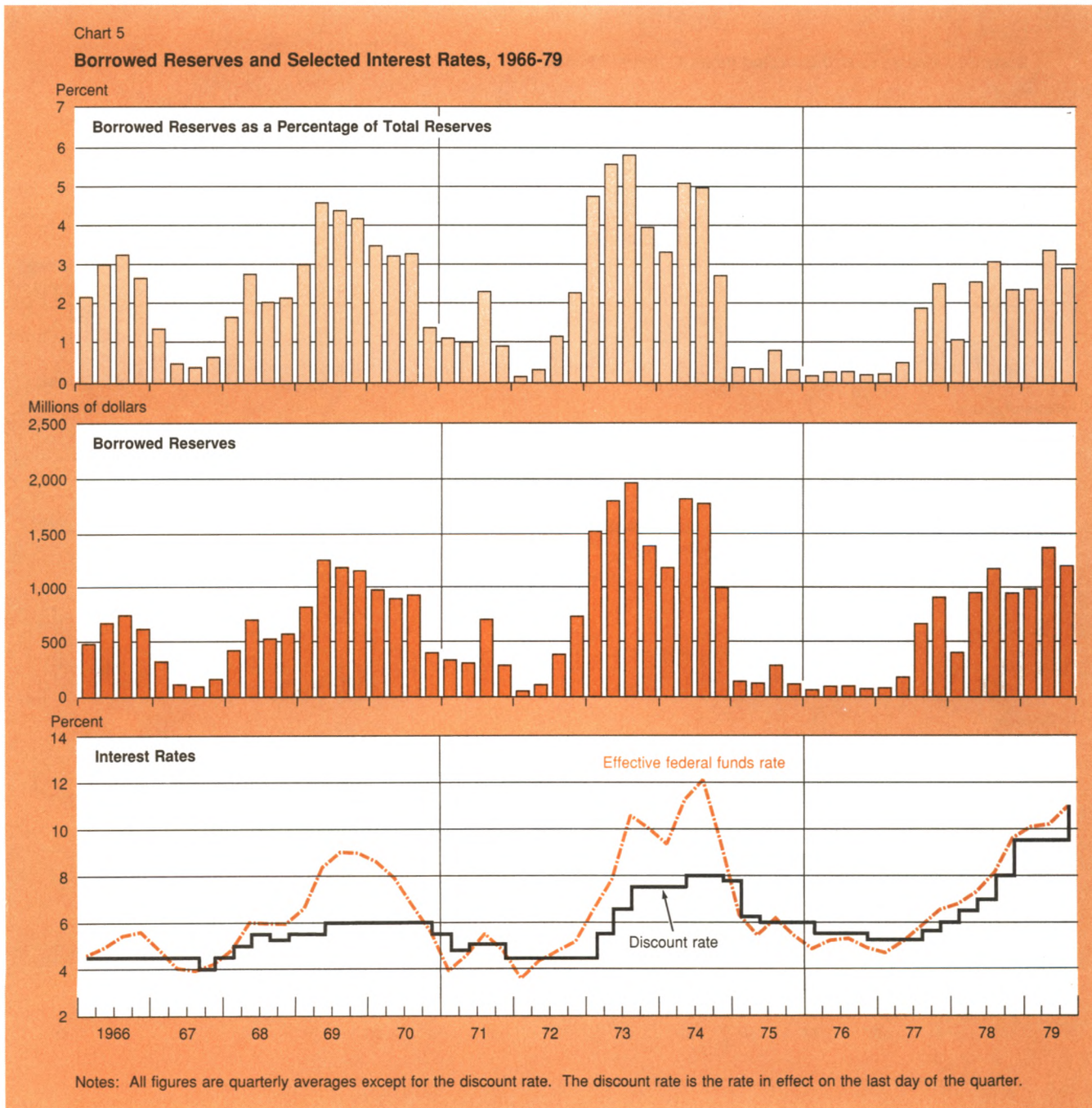
1966 67 68 69 70 71 72 73 74 75 76 77 78 79

Notes: All figures are quarterly averages except for the discount rate. The discount rate is the rate in effect on the last day of the quarter.

1950s and early 1960s generally followed the pattern set out by the committee's guidelines. There was some debate about whether the reluctance to borrow was motivated by the banks' own caution or by Federal Reserve restrictions. Some banks almost never borrowed, suggesting an internally generated reluctance. Many banks, however, apparently took account of the full cost of borrowing, including potential loss of future access, and borrowed when it was profitable. In that context, borrowing was rarely a large bargain. In fact, the discount rate was often slightly above short-term Treasury bill rates, although both borrowing and the incentive to borrow varied cyclically. Normally, borrowing was only a modest share of total Federal Reserve credit.

The Board of Governors approved periodic adjustments to the discount rate and issued a statement of purpose with each adjustment. Often the changes lagged market rates, and the Board explained its action as an effort to catch up with market rates. When the discount rate was low relative to other short-term rates, borrowing often rose. (The primary alternative rate was the Treasury bill rate in the 1950s; the federal funds market grew in importance during the 1960s.)

Some academic economists criticized the discount mechanism. They did not like the fact that banks were given mixed signals about borrowing, with the relatively low discount rate often encouraging use of the window while the administrative guidelines were discouraging it. They felt that the rules made it difficult to judge whether policy was tight or easy.[41] The authors preferred a rate that was set above market rates—a penalty rate—but urged that no administrative restrictions be placed on borrowing.

Discount window policy in the late 1960s and 1970s
Higher interest rate levels in the latter half of the 1960s, especially the "tight money" episode of 1966, encouraged more borrowing (Chart 5). The decline in membership was also garnering attention, and there was concern that the discount window was not sufficiently available to small member banks. A series of studies were undertaken during the late 1960s under the guidance of a steering committee of Federal Reserve Governors and Presidents.[42] The studies reviewed the history of the discount mechanism, compared the discount window with the tools and techniques of foreign central banks, evaluated some of its problems, and presented several possible reforms. The steering committee endorsed the practice of permitting banks to borrow only intermittently. It wanted to continue the administrative disincentives to frequent borrowing, but it was troubled that some banks seemed to get little or no benefit from the window. The summary report recommended some changes to make borrowing more convenient, especially for small unit banks with large seasonal swings in loan demand and limited access to the national credit markets. The report's recommendation of a special seasonal borrowing privilege for small member banks was adopted in 1973 and remains in effect, although it has been modified somewhat in recent years.[43]

The report also proposed that one form of adjustment credit should consist of a basic borrowing privilege that would give all (member) banks some access at reasonable cost to Federal Reserve credit based on published guidelines for amount and frequency of borrowing. Even the proposed basic borrowing privilege did not envision continuous borrowing: if a bank needed additional credit, its borrowing would be subjected to scrutiny. The approach was not adopted, although the proposed frequency schedule did influence the informal guidelines used by the discount officers in subsequent years. Finally, the study brought to light considerable inconsistencies in the administration of the window by the different Federal Reserve Banks. Efforts were made to improve coordination in order to minimize those differences.

During the 1970s, Federal Reserve monetary policy focused on adjusting the federal funds rate to respond to deviations in money growth from desired ranges. The discount window generally played a subsidiary role in the process.[44] Changes in the discount rate were often motivated by changes in market rates, as they had been

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[41]See Friedman, A Program for Monetary Stability, pp. 38-41; A. James Meigs, Free Reserves and the Money Supply (Chicago: University of Chicago Press, 1962); and Warren Smith, "The Discount Rate as a Credit-Control Weapon," Journal of Political Economy, April 1958, pp. 171-77.

[42]Board of Governors of the Federal Reserve System, Reappraisal of the Federal Reserve Discount Mechanism, 1971.

[43]The seasonal borrowing privilege was extended to nonmember banks under the MCA. In 1992, the Board began charging a market rate on seasonal borrowing tied to the federal funds rate and certificate of deposit rates.

[44]Economists have debated the importance of the discount rate as a mechanism for changing policy. Sometimes Federal Reserve announcements indicated that the rate was changed to catch up with market rates. At other times they cited monetary policy concerns. At issue is whether these announcements had an impact beyond that of open market operations. See Timothy Cook and Thomas Hahn, "The Information Content of Discount Rate Announcements and Their Effect on Market Interest Rates," Journal of Money, Credit, and Banking, vol. 20, no. 2 (May 1988), pp. 168-80; Raymond E. Lombra and Raymond G. Torto, "Discount Rate Changes and Announcement Effects," Quarterly Journal of Economics, February 1977, pp. 171-76; and Daniel L. Thornton, "The Market's Reaction To Discount Changes: What's Behind The Announcement Effect?" Federal Reserve Bank of St. Louis, Working Paper Series, November 1991, pp. 2-23.

in earlier decades, although occasionally changes were intended to create an announcement effect.[45] The amount of borrowing generally increased as the federal funds rate rose relative to the discount rate, a relationship that suggested that banks were seeking to maximize profits through their borrowing decisions. The Open Market Trading Desk took that relationship into account when choosing how many nonborrowed reserves to provide, since the amount of desired borrowing affected the reserve levels consistent with the desired funds rate.

Relation between discount policy and reserve targeting from 1979 to 1982

Borrowing took on increased importance after the October 1979 changes to reserve operating procedures. Under the new procedures, the Trading Desk provided only the level of nonborrowed reserves estimated to be consistent with targeted M1. If depositories needed additional reserves to meet their requirements because M1 was above target, they would have to borrow them at the discount window. In practice, the system was structured so that there was some borrowing even when M1 was on target. Only when M1 was far below target for a while in 1980 was borrowing allowed to drop to frictional levels, leading the federal funds rate to fall below the discount rate.

The adjustment mechanism depended heavily on the enforced reluctance to borrow. When banks borrowed to satisfy their reserve requirement, they reduced their future access to the discount window. Consequently, when the banking system as a whole had to borrow a higher volume of reserves to meet requirements, individual banks would bid up the federal funds rate as they tried to avoid being one of the banks that turned to the window. The process gave banks the message to cut back on deposit-expanding activities. Chart 6 gives key borrowing and interest rate relationships during these years.

The move to the new procedures inspired discussion of the appropriate guidelines for setting and changing the discount rate. Some Board members initially had expected that the discount rate would be changed more frequently than before to keep it more closely aligned with market rates. In practice, the basic discount rate was changed fairly frequently—sixteen times between October 1979 and October 1982—but it still moved much less than the funds rate. At times, unprecedented weekly average spreads developed between the funds rate and the discount rate.

[45]In November 1978, reserve requirements, the discount rate, and the funds rate target were all raised simultaneously as a dramatic gesture to attack the rising rate of inflation and the weakening exchange value of the dollar.

During two periods of exceptionally restrictive provision of nonborrowed reserves, in 1980 and again in 1981, the volume of borrowing ran very high. The Board

Chart 6

Borrowed Reserves and Selected Interest Rates, 1979-82
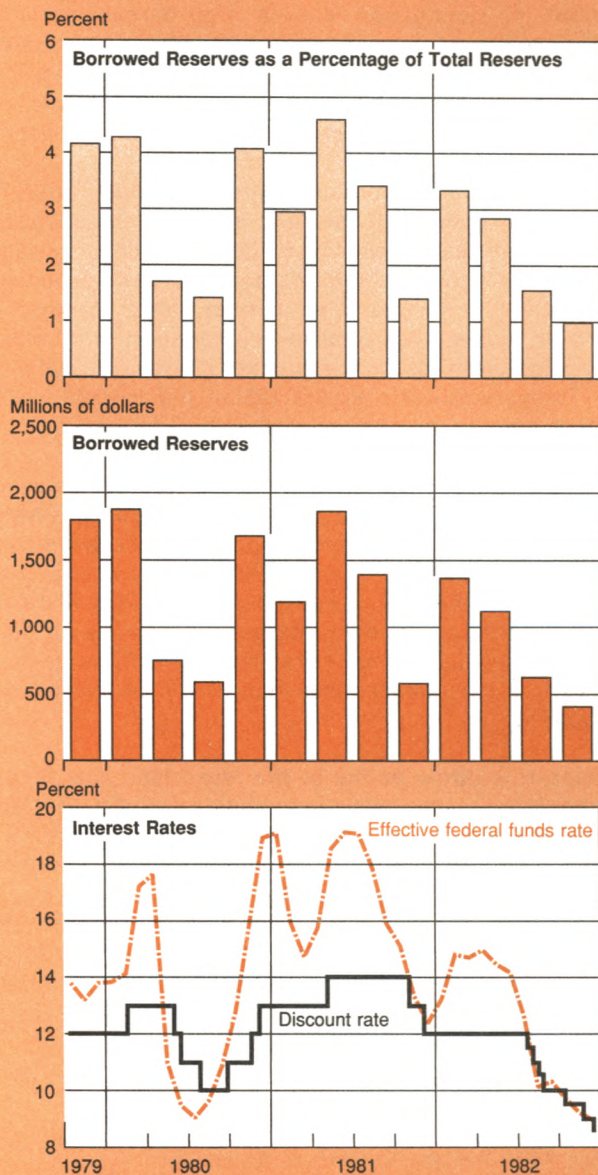
Notes: Borrowed reserves are quarterly averages. Federal funds are monthly averages. Discount rates are actual rates announced by the Federal Reserve Bank of New York.

introduced a surcharge on frequent borrowing by large banks as part of the Administration's credit restraint program in March 1980.[46] The frequency limits for access at the basic rate were similar to those that had been proposed a decade earlier for the basic borrowing privilege. In addition, banks did not have unlimited access to the discount window even when they paid the surcharge. The funds rate often exceeded even the combined basic rate and surcharge—which reached a high of 18 percent in 1981.[47]

Borrowed reserve targeting in the 1980s and early 1990s

Borrowed reserve targeting replaced nonborrowed reserve targeting in 1983 as the primary guide for choosing desired reserve levels. The shift in emphasis removed the automatic linkage between reserves and money targets. Borrowed reserve targeting made more formal use of the relationship between the amount of borrowing and the spread of the federal funds rate over the discount rate that arises from the restrictions on heavy use of the discount window. As was the case under the previous procedures, forcing increased borrowing tended to lead banks to bid up the federal funds rate relative to the discount rate as they sought to avoid having to borrow. Reduced borrowing encouraged less aggressive bidding for federal funds, and the rate would fall. The FOMC raised borrowed reserve objectives when it wanted to tighten policy and lowered them when it wanted to ease policy.[48] Chart 7 shows key borrowing and rate relationships during these years.

A change in the discount rate was viewed as a substitute for a change in the borrowing assumption. Whenever the discount rate was raised or lowered, the FOMC made an explicit decision whether that action by itself accomplished the desired policy adjustment. On some occasions, the amount of assumed borrowing was left unchanged so that the average federal funds rate would be expected to rise or fall by the same amount as the discount rate. At other times, the borrowing allowance was changed in a direction that lessened the impact of the discount rate change. For example, the FOMC would raise the borrowing assumption when the discount rate was lowered so that the average funds rate would fall by less than the discount rate.

Increased reluctance to borrow in the 1980s and early 1990s

A series of banking crises and failures beginning in 1982 reintroduced a source of reluctance to borrow that had largely disappeared after the 1930s. Once again, banks became concerned that borrowing at the discount window might be interpreted as a sign that they were so weakened financially that they could not borrow funds from normal sources. The concern was especially high in 1984, when Continental Illinois National Bank suffered a crisis of confidence, experienced runs by its large depositors, and was forced to borrow massive amounts from the Federal Reserve to keep operating. Continental's experience made many other banks more hesitant to borrow, and wider spreads of the funds rate over the discount rate emerged for a given amount of borrowing fostered by the Federal Reserve. As more banking crises developed and then were resolved, the reluctance to borrow became alternately more and less severe, but it never returned to its pre-1984 pattern.

By the fall of 1987, the borrowing relationship became sufficiently uncertain that the Federal Reserve felt compelled to reduce its reliance on it as a guide to policy. Since that time, the Fed has given greater weight to indicators of money market conditions such as the federal funds rate. Nonetheless, the extreme reluctance to borrow and the resulting uncertainty about how banks will respond to changing levels of reserve availability have also introduced some volatility to the funds rate. When banks have not wanted to borrow, they have reacted to a reserve shortage by bidding up the funds rate to very high levels before they finally turn to the discount window. Indeed, on one occasion in 1990, the funds rate reached 100 percent, a level not seen even when interest rates and borrowing levels were routinely much higher a decade earlier. Although efforts have been made to explain to the banks and the public that occasional borrowing is an appropriate action to relieve temporary shortages of reserves, the message has so far had limited impact.

The reluctance to borrow has compounded the reserve management difficulties associated with low reserve requirements, described in the previous section. The low requirements reduced depositories' ability to handle normal day-to-day variation in reserve flows because the range of reserve levels that fell between

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[46]A more detailed discussion of the rationale underlying the program of credit restraint is given in a statement by Frederick H. Schultz, Vice Chairman, Board of Governors of the Federal Reserve System, before the Subcommittee on Access to Equity Capital and Business Opportunities of the House Committee on Small Business, April 2, 1980. It is reprinted in the *Federal Reserve Bulletin*, April 1980.

[47]The surcharge was initially imposed in March 1980. It was then removed in May of that year, only to be reimposed in September. In 1981, the surcharge underwent further changes. It was increased in May, reduced in September, reduced again in October, and finally eliminated in November.
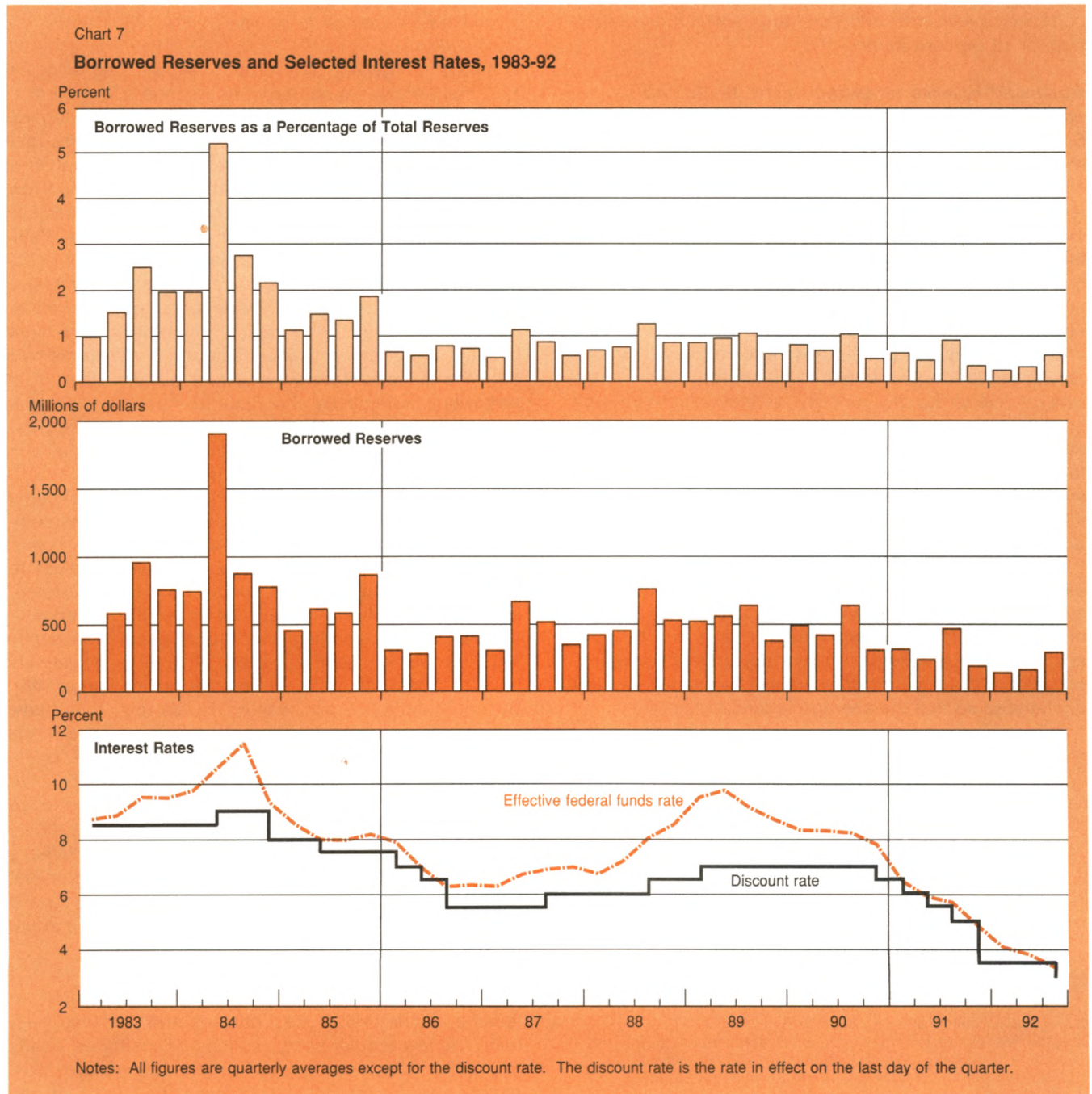
[48]Marvin Goodfriend, "Discount Window Borrowing, Monetary Policy, and the Post-October 6, 1979 Federal Reserve Operating Procedure," *Journal of Monetary Economics*, September 1983, pp. 343-56, offers a critique of that relationship and suggests that it will inevitably be unreliable.

excess reserves and overdrafts narrowed. The extreme reluctance to borrow weakened one means for banks to recover from an unexpected reserve shortage.

Conclusions

Required reserves and the discount window can be important supplements to open market operations in implementing monetary policy. Open market operations function more smoothly when both required reserves and the discount window are used in ways that contribute to a stable and predictable demand for reserves. The difficulties in managing reserves that arose in

Chart 7

Borrowed Reserves and Selected Interest Rates, 1983-92

Percent

Borrowed Reserves as a Percentage of Total Reserves

Millions of dollars

Borrowed Reserves

Percent

Interest Rates

Effective federal funds rate

Discount rate

Notes: All figures are quarterly averages except for the discount rate. The discount rate is the rate in effect on the last day of the quarter.

recent years when these two tools were not functioning as intended underscored their potential value.

Required reserve ratios have fallen substantially on balance over the last four decades, primarily because untenable distortions arose from the implicit tax associated with relatively high requirements on which no interest was paid. The decline in ratios has been dramatic—from a top rate of 24 percent in 1951 to a top rate of 10 percent today. Furthermore, vault cash now meets over half of requirements, in contrast to 1951 when it could not be used for that purpose. Thus, required reserve balances are now only slightly above 1951 levels despite a sevenfold increase in checkable deposits.

Although the reductions in distortions associated with the declining reserve requirement tax have been helpful to the functioning of the banking system, the recent low levels of required reserve balances relative to the needs of the banks for clearing and settlement purposes have reduced the stability of the demand for reserves. Thus, policymakers must continue to balance conflicting considerations in choosing the appropriate level of required reserves.

The discount window has, overall, been a useful tool of monetary policy since the Accord. It has supplemented open market operations as a source of reserves and provided flexibility to handle reserve shortages late in the day when open market operations are not feasible. The Federal Reserve has found some amount of discount window borrowing helpful in regulating the availability of reserves on the margin. Nonetheless, the Fed has discouraged the banks from becoming heavily dependent on borrowed reserves. Administered limitations on borrowing have offset the influence of discount rates that were generally below market rates, ensuring that the discount window would not become a major source of total reserves.

Recently, in the wake of a number of bank failures, the reluctance to borrow has been reinforced by banks' worries that their reputations could be tarnished if they were seen as needing credit from the window. As a result, the discount window has been less useful as an adjunct to open market operations because the banks' borrowing patterns have become less dependable. Until general confidence in the banking system is restored—a process that is under way but far from complete—the discount window's value to the policy process is likely to remain diminished and open market operations will suffer reduced flexibility.

The Relative Cost of Capital for Marginal Firms over the Business Cycle

by Gikas A. Hardouvelis and Thierry A. Wizman

This article explores the differential effects of the business cycle on the opportunity cost of raising funds, the so-called cost of capital, for a cross-section of firms in the economy. Although much anecdotal evidence on the differential cost-of-capital effects exists, macroeconomists have not examined this issue rigorously. Traditional economics textbooks typically assume that the cost of capital is uniform across all firms in the economy. Empirical macroeconomic models rarely distinguish between the relative costs of capital for different types of firms. Furthermore, monetary policy in the United States does not aim at controlling credit selectively for different business sectors or types of firms.

Despite the dearth of economic research on this issue, informed opinion has long held that swings in business activity do not affect all firms equally. In particular, the performance of small firms or financially distressed firms has been considered susceptible to variation in economic conditions. Hence the cost of capital for such "marginal" firms may show greater cyclicality, responding with particular sensitivity to the advent of recessions. A "flight to quality" by investors anticipating hard times, or a general change in investors' attitudes toward risk as their own positions deteriorate, may disproportionately affect the cost of capital for firms that bear more systematic risk than their larger or stronger counterparts.[1]

The reallocation of capital away from marginal firms during cyclical downturns can have important aggregate repercussions. An economy in which economic hardships are not equally distributed across firms is more vulnerable to adversity. A mild recession may turn into a severe recession following a wave of bankruptcies by marginal firms unable to refinance their obligations at relatively low costs.[2] Because variation in the costs of capital across firms can have such consequences, the issue deserves fuller exploration.

We begin our analysis by defining the cost of capital and describing our methods of measuring it. Next we examine how the cost of capital for a representative firm on the New York Stock Exchange and the American Stock Exchange varies with changes in the business

Footnote 1 continued
to bankruptcy in recessions, the probability-weighted or expected bankruptcy cost as a share of assets may increase more for marginal firms. Since this cost must be subtracted from tangible assets to derive the expected value of collateral, marginal firms may experience a greater deterioration in the expected value of collateralizable net worth, thereby incurring a relatively high external cost of capital ("Financial Factor in Business Fluctuations," in *Financial Market Volatility: Causes, Consequences and Policy Recommendations*, Federal Reserve Bank of Kansas City, 1988).

[2]William Lang and Leonard Nakamura present an example in which the loss of firms during a recession may lengthen the recession ("The Dynamics of Credit Markets in a Model with Learning," *Journal of Monetary Economics*, vol. 26 [1990], pp. 305-18). The relative capacity of small and large firms to borrow over the business cycle is examined in two recent articles: Stephen Oliner and Glenn Rudebusch, "The Transmission of Monetary Policy to Small and Large Firms," Board of Governors of the Federal Reserve System, Working Paper, 1992; and Mark Gertler and Simon Gilchrist, "The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence," Board of Governors of the Federal Reserve System, Working Paper, 1992.

[1]Additional channels of influence exist in an environment with asymmetric information. Mark Gertler and R. Glenn Hubbard have shown how a general deterioration in the collateral value of corporations during recessions might lead to higher capital costs for troubled firms. In an environment with asymmetric information, lenders require collateral value. If marginal firms come much closer

cycle. The bulk of the empirical work deals with the cross-sectional differences among these firms. All non-financial firms traded on the New York and American stock exchanges are divided into portfolios according to accounting characteristics such as size, the ratio of book equity to market equity, leverage, and earnings. We then consider how the short-term cost of capital differs across the extreme portfolios and trace these differences throughout the sample period 1963-91. Finally, we estimate the cross-sectional sensitivity of the short-term cost of capital to different risk measures and track this sensitivity over the business cycle. Our analysis reveals that the relative cost of capital for marginal firms exhibits a counter cyclical pattern. We attribute this finding in part to a cyclical pattern in the cross-sectional sensitivity of the short-term cost of capital to the risk measures of size, book-to-market equity, and leverage.

What is the cost of capital?

Chief financial officers traditionally measure the cost of capital as the *weighted-average cost of capital* (WACC). The WACC is typically expressed as a weighted average of the expected returns to the equity- and debt-holders of the firm:

$$(1) \qquad WACC \equiv e \times [E(r^e)] + (1 - e) \times [E(r^d)].$$

$E(r^e)$ and $E(r^d)$ are the expected—or required—returns on equity and debt, respectively, and e is the share of equity in the total market capitalization of the firm.

To understand why the WACC is the opportunity cost of capital, consider the example of a firm contemplating an investment requiring an initial capital expenditure of $50 million that is expected to yield a cash flow of $60 million in the next year. The firm will compare the benefit from the project with the benefit that would arise if the firm committed the same $50 million to a financial investment with comparable risk. If the expected benefit from the financial investment exceeds the benefit associated with the project, then the firm will forgo the capital expenditure and the project. The benefit from the financial investment, expressed as a rate of return, is the opportunity cost of a capital expenditure, or the cost of capital.[3]

In using WACC as a measure of the cost of capital, the finance literature assumes that the risk of the capital expenditure project is comparable to the average risk of

[3]To be sure, a firm making a capital budgeting decision must also match the financial return "horizon" with the lifespan of the prospective capital project to arrive at an appropriate cost of capital. For example, the return on a project that is expected to earn a cash flow over the next ten years must be compared with the return on the firm's financial claims over the same period if the capital project is not reversible and cannot be liquidated.

the firm's existing projects and that the financial markets are able to perceive and price the latter risk properly. However, the average risk of a firm's existing projects is equal to the average risk of the firm's debt and equity because of the balance sheet identity that equates the value of assets with the value of liabilities plus net worth. It follows that the opportunity cost of the commitment to the new project is the expected benefit from the financial investment of buying the existing mix of the firm's equity and debt, the WACC of equation 1. The higher this weighted average, the higher the cost of capital, and the less likely that new capital projects will be undertaken today.

In equation 1, the expected return on equity is the dividend yield, or dividends paid per share (D/P), plus the expected capital gain yield, or percentage change in price ($\Delta P/P$). The expected return on debt (for a one-period fixed-principal loan, for example) is positively related to the probability of default, π, and the interest rate charged, i, which in turn is usually expressed as a benchmark fixed rate (LIBOR, PRIME, T-BILL) plus a margin to reflect the risk class of the borrower.

Equation 1 helps illustrate how policy actions influencing the expected return on financial assets are linked to the level of capital expenditure by firms. Actions that increase a benchmark rate of interest increase the expected return on debt directly through i. But they also increase WACC indirectly through the expected return on equity, since investors seeking the highest risk-adjusted rates of return will bid down this price until the expected return on an equity investment reflects equity's opportunity cost. In this manner, the capital budgeting decisions of firms and the policy actions of governments are linked.

Measuring the cost of capital

In theory, measuring the weighted average cost of capital is straightforward: one first determines the costs of the individual sources of capital, equity and debt, and then computes the weighted average of these costs. In practice, however, the expected return on the debt portion is difficult to estimate. First, a database containing the rates of return on the debt instruments for a large group of firms does not exist, mainly because most debt instruments trade in thin markets and not all firms issue debt in organized markets. Second, small, risky firms usually do not have access to debt markets and instead rely upon banks for both short- and long-term borrowing. Unlike interest rate data from organized capital markets, data on contractual bank interest rates are largely undocumented. Third, even if we assume that a contractual rate of interest exists and is observable for all classes of firms and at each point in time, we cannot readily construct the corresponding expected return on

debt. The reason is that the contractual rate on a loan will differ from the expected return on that loan whenever default on the principal is possible, and the probability of default, π, is hard to estimate.

Unlike data from the debt markets, data from the stock markets are readily available. The Center for Research in Securities Prices, for example, maintains a database of monthly returns for all stocks traded on the New York Stock Exchange and the American Stock Exchange since 1962. For 1991, the database includes more than 5,000 firms, only a subset of which have access to organized nonintermediated debt markets. The wide availability of stock price data suggests that the expected return on equity may serve as the most practical proxy for the cost of capital for a wide range of firms.

Nevertheless, we need to consider how much a measure based on required stock returns alone would differ from the WACC. Theoretical considerations suggest that it will differ little. First, the market value of equity figures prominently in the value of total corporate capital, 70 percent on average over the sample period examined. Second, the required return on equity and the required return on debt are positively correlated. They share a common risk-free return, and their respective risk premia tend to move in the same direction over the course of the business cycle. Thus, for the purpose of studying the time variation in the *relative* cost of capital for firms differing by size, solvency, and net worth, data on the return to equity capital may be the most feasible guide. We pursue this approach below.

Predictability of stock returns and the cost of equity capital
We construct a time series of expected monthly returns for a firm (or portfolio of firms), j, by regressing the time-series of its realized monthly real stock returns, r_j^e, on a number of state variables, $s_1, \ldots, s_n$. The state variables are observable measures that proxy for the fundamental determinants of expected monthly stock returns: the risk-free interest rate, the underlying unobservable risk of equity investments, and the price of that risk. The regression equation is as follows:

$$(2) \quad r_{j,t+1}^e = b_0 + b_{j,1}s_{1,t} + \cdots + b_{j,n}s_{n,t} + u_{j,t+1}.$$

By the properties of ordinary least squares, the fitted value from this regression, call it $\hat{r}_{j,t+1}^e$, is an unbiased conditional estimate of the expected rate of return $E_t(r_j^e)$. This is true even if we have misspecified the regression equation by omitting pertinent state variables that help forecast r_j^e. Because the realized return is regressed on a set of lagged state variables, the fitted value is unambiguously an ex ante return. The regression residual, u_j,

represents the unanticipated component of the real stock return, which is driven by the effect of contemporaneous news.

Our use of a monthly return horizon for stocks is intended to capture the exact turning points of the cost of capital over the business cycle. Nevertheless, the choice of monthly returns is not innocuous and implies a specific interpretation of the cost of capital as a short-term equity cost of capital. The short-term cost of capital particularly affects a firm's choice of the optimal time to begin a long-term project. If the expected monthly financial return is high, a firm has an incentive to delay undertaking a long-term project in favor of reevaluating the relative merits of the project one month hence.[4]

What set of variables best determines expected returns? Recent research has isolated certain variables that help to predict returns on broad stock market indexes. Campbell and Shiller use the slope of the term structure of interest rates and the dividend yield on stocks as predictors of market returns. Fama and Schwert use inflation; Keim and Stambaugh, the yield spread between bonds of varying quality. Fama and French examine simultaneously the dividend yield, the term structure spread, and the default risk spread to predict both excess stock and bond market returns. Chen considers each of the state variables listed above as well as the level of short-term interest rates.[5]

The ability of financial variables to predict returns is not surprising. Prices derived in efficient financial markets incorporate investors' and borrowers' current per-

[4]For example, suppose that the current short-term cost of capital is 10 percent per period but is expected to revert to 5 percent per period next period and to stay at that level perpetually, so that the effective long-term cost of capital is 5 percent per period. A new firm with 100 dollars in cash is contemplating committing this sum to a capital project whose initial cost is 100 dollars any time the firm undertakes it. The project is expected to generate 5 dollars per period in perpetuity. The value of the firm in the next period will be 100 dollars, independent of the firm's decision to postpone the project or take it up immediately. However, the value of the firm today does depend on the timing of the project. If the firm commits the cash today, the market value of the firm today will fall to 95.45 dollars because this is the value that will make the expected capital gain return over the next year ([5/95.45]x100 percent) plus the cash flow return ([5/95.45]x100 percent) equal to the current required 10 percent return. To avoid a capital loss, the firm will postpone the investment to the next period.

[5]John Y. Campbell, "Stock Returns and the Term Structure," *Journal of Financial Economics*, vol. 18 (1987), pp. 373-99; John Y. Campbell and Robert J. Shiller, "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors," *Review of Financial Studies*, vol. 1 (1988), pp. 195-228; Eugene F. Fama and William Schwert, "Asset Returns and Inflation," *Journal of Financial Economics*, vol. 5 (1977), pp. 115-46; Donald B. Keim and Robert F. Stambaugh, "Predicting Returns in the Stock and Bond Markets," *Journal of Financial Economics*, vol. 17 (1986), pp. 357-90; Eugene F. Fama and Kenneth R. French, "Dividend Yields and Expected Stock Returns," *Journal of Financial Economics*, vol. 22 (1988), pp. 3-26; Nai-Fu Chen, "Financial Investment Opportunities and the Macroeconomy," *Journal of Finance*, vol. 46 (1991), pp. 529-54.

ceptions about the risk of future prospects as well as the underlying time discount rates. Investors' required rate of return in the stock market is not unrelated to their required rate of return from other assets. The observable prices of those other assets can, therefore, be useful in capturing the unobservable required rate of return in the stock market. We use these variables in our empirical exercises below.

This regression approach differs from the traditional approach to estimating the expected return on equity. The traditional approach, drawing on the capital asset pricing model (CAPM) of Sharpe, Lintner, and Markowitz, measures risk directly using the asset's "beta," that is, the covariance of the asset's return with the return on the stock market.[6] Recent evidence, however, suggests that proxies for beta constructed using historical returns may suffer from measurement error and may not bear any relationship to expected returns.[7] Rather than measure risk directly, our regression approach assumes that variation in fundamental risk and the price of that risk, although unobservable, are captured by the state variables.

Estimating the cost of capital for the representative firm
We estimate the cost of capital for a "representative" firm—that is, one that has risk-return characteristics similar to the stock market as a whole. The expected return for such a firm is the expectation of the value-weighted average of returns for all firms in the stock market.

Panel A of Table 1 presents evidence of the power of the economic and financial variables to predict the real return of the representative firm. The real return is the one-month value-weighted return on the New York Stock Exchange minus the rate of consumer price inflation. The table summarizes the results of regressing the real return on the values of the following predictive variables: the spread between yields on Aaa-rated and Baa-rated corporate bonds, QUAL; the spread between yields on ten-year Treasury bonds and three-month Treasury bills, TERM; the twelve-month percentage change in the consumer price index, INFL; cumulative dividends over the past twelve months divided by the last month's New York Stock Exchange price index (a

dividend yield), DYLD; and the three-month Treasury bill rate, TBIL. All independent variables are lagged one period in the regression. The box contains a more detailed description of the state variables.

The regression sample runs from August 1958 to December 1991. Although using a higher order lag specification increases the adjusted R^2 in some cases, it does not appreciably change the time series behavior of the fitted values of the regression. In the spirit of parsimony, therefore, we use the one-lag specification.

The results support a finding that the chosen variables are determinants of stock returns. With the exception of *TERM*, each predictive variable is significant at the 1 percent level. Furthermore, the estimation indicates that 11 percent of the variation in stock market returns can be explained using only one lag of the predictive variables. Since the monthly stock returns exhibit high variability, an R^2 of 11 percent is quite high

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Table 1
The Cost of Capital of the Representative Firm
August 1958-December 1991

Panel A: Predicting the Real Return on the Value-weighted NYSE Index

$RRET_t =$
$\quad \beta_0 + \beta_1 QUAL_{t-1} + \beta_2 TERM_{t-1} + \beta_3 INFL_{t-1} + \beta_4 DYLD_{t-1} + \beta_5 TBIL_{t-1} + u_t$

β_0	β_1	β_2	β_3	β_4	β_5
−0.04	2.77	−0.55	−0.31	2.24	−0.65
(0.01)	(0.82)	(0.29)	(0.12)	(0.56)	(0.16)
	0.027	0.008	0.014	0.050	0.034

$R^2 = 0.11$ Durbin-Watson = 1.92

Panel B: The Cost of Capital of the Representative Firm over the Business Cycle

Change from Trough to Peak (Average across Six Recoveries)	Change from Peak to Trough (Average across Six Recessions)
−3.51	2.12

Notes: See the box for the definitions and descriptions of the variables. Inside the parentheses in panel A are standard errors corrected for conditional heteroskedasticity using the method in Halbert White, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and Direct Test for Heteroskedasticity," *Econometrica*, vol. 48 (1980), pp. 817-38. The third row in Panel A reports the partial R^2 associated with each independent variable. Peaks and troughs in Panel B correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: April 1960, August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: April 1961, December 1966, November 1970, March 1975, July 1980, and November 1982.

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[6]William F. Sharpe,"Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, vol. 19 (1964), pp. 425-42; John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, vol. 47 (1965), pp.13-37; Harry Markowitz, *Portfolio Selection: Efficient Diversification of Investments* (New York: Wiley, 1959)

[7]See Eugene F. Fama and Kenneth R. French, "The Cross Section of Expected Stock Returns," *Journal of Finance*, vol. 47 (1992), pp. 427-65.

but nonetheless unsurprising. As we mentioned earlier, in efficient markets, financial variables readily incorporate all current information about future economic prospects.

Table 1 also reports the *partial* R^2 of each predictive variable, defined as the loss in R^2 when the variable is removed from the general one-lag specification. The reported partial-R^2s suggest that the greatest loss in predictive power comes from excluding the dividend yield.

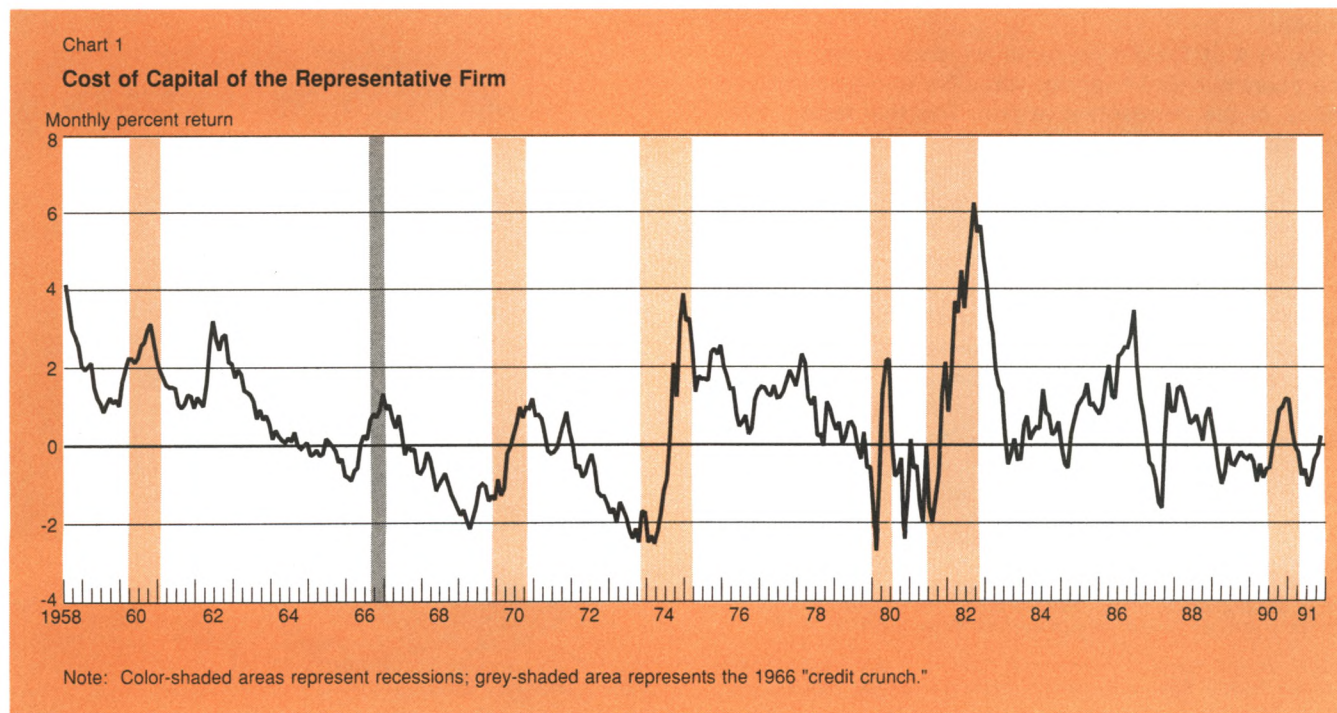### The aggregate cost of capital over time

Chart 1 plots the cost of capital of the representative firm over three decades from 1958 to 1991. Color-shaded areas in the chart indicate periods of recession as defined by the National Bureau of Economic Research. The 1966 "credit crunch," which we date from August to December of 1966, is shaded in grey.[8]

Although the time-series mean of the expected monthly return on the representative firm is 0.6 percent (or 7.4 percent annualized), the chart shows that the aggregate cost of capital is not constant but has a strong cyclical property, reaching a peak toward the end of recessions. During recoveries it tends to decrease or stay the same.

[8]See Mark Wolfson, *Financial Crises* (Armonk, New York: M.E. Sharpe, 1982).

Other features of Chart 1 are also noteworthy. First, expected returns are especially volatile in the early 1980s. This period is characterized by strong gyrations in short-term interest rates (as well as in the term structure and quality spreads), a pattern that reflects economic uncertainty. Second, during the mid-1970s, there appears to be a string of *negative* expected returns. Although we would not expect the cost of capital to be negative, a negative measured expected return on the stock market may indicate measurement error. Alternately, the cost of capital in this period may indeed be negative. The negative expected return in the mid-1970s is not specific to the stock market. Huizinga and Mishkin show that during the same period the real rate of interest was negative. McCauley and Zimmer, using a different technique to approximate the cost of capital, find that this cost was negative during the part of the 1970s covered in their sample.[9] Although investors may have anticipated higher inflation in this period, nominal interest rates did not adjust one-for-one with the increase in inflationary expectations. Whatever the explanation, the negative cost of capital estimates for

[9]See John Huizingua and Frederic Mishkin, "Monetary Policy Regime Shifts and the Unusual Behavior of Real Interest Rates," Carnegie-Rochester Conference on Public Policy, vol. 24 (1986), pp. 231-74; Robert McCauley and Steven Zimmer, "Explaining International Differences in the Cost of Capital," this *Quarterly Review*, vol. 14, no. 2 (Summer 1989), pp. 7-28.

Chart 1

Cost of Capital of the Representative Firm

Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

the aggregate stock market in the 1970s do not affect our main analysis, which concentrates on the *relative* cost of capital between types of firms.

Another feature in Chart 1 that requires some explanation is the extreme values assumed by the expected return at the troughs of the 1974 and 1982 recessions. In the 1982 episode, this value is 6 percent, or four times the historical mean, measurement error notwithstanding.[10] If compounded over twelve months, a 6 percent monthly return implies an annualized return of more than 100 percent. The implied annualized rate may not appear realistic either as an expected rate of return over a year or as a "hurdle rate" that prospective projects must meet to be judged worthwhile. Recall that our measure of the cost of capital is a short-term cost affecting the decision to postpone the project for a month in order to reevaluate its relative merits. Thus considered, an occasional monthly cost of capital of 6 percent, if short-lived, is not unrealistic. As Chart 1 indicates, the expected monthly rate of return may have a strong tendency to revert to its average value following large swings away from its norm. Thus, unusually large or small ex ante monthly rates of return are not necessarily expected to persist. A firm considering a capital project with a life of one year would probably not have gauged the project's expected long-term return against a cost of capital of 100 percent, but rather against a cost closer to the long-run annual return of 7 percent, albeit higher.[11]

The average change in the representative firm's cost of capital during recoveries and recessions is summarized in Panel B of Table 1. The monthly cost of capital falls by 351 basis points from trough to peak and rises by 212 basis points from peak to trough.

Evolution of the relative cost of capital of marginal firms
Constructing portfolios of firms
This section analyzes the relative cost of capital for a cross-section of firms ranked by measures of size, financial distress, and leverage. We use monthly common stock returns of nonfinancial firms listed on the New York Stock Exchange and the American Stock Exchange whose returns data appear in the monthly tapes of the Center for Research in Securities Prices

tapes and whose income and balance sheet data appear in Standard and Poor's Industrial COMPUSTAT tapes.

Our analysis requires operational definitions of the criteria of size, distress, and leverage. We rely on the measures of operating performance that have been shown in earlier empirical studies to explain the cross-sectional variation in average stock returns.[12] We measure the *size* of a firm by the total market value of its equity (ME). One measure of distress is the ratio of book equity to market equity (BE/ME). A high value of book equity to market equity indicates that investors forecast poor future performance (a low market equity) relative to the firm's past performance (a high book equity). Distress is also associated with insolvency. Firms with negative current earnings (before special charges and extraordinary items) are less solvent; firms with positive current earnings are more solvent. Finally, we define leverage as the ratio of the balance sheet value of debt to the market value of equity (D/ME). The debt-to-market equity ratio is taken to be a measure of the future debt burden, although it may not be a good indicator of the current interest payment burden.[13] A detailed description of the accounting variables can be found in the box.

Our analysis uses portfolios of firms to reduce the importance of idiosyncratic error attaching to the use of individual firms. We construct sixty portfolios based on three quantitative accounting criteria: market equity (ME); book-to-market equity (BE/ME); and debt-to-market equity (D/ME). We also construct two additional portfolios using a binary earnings (E) criterion: negative earnings or positive earnings.

For a given year, the first group of portfolios (numbers 1-20) is constructed by first ranking all firms in ascending order according to their market value of equity at the end of the previous December and then partitioning them into twenty equal groups by number. Portfolio 1, therefore, contains the smallest firms and portfolio 20 the largest firms, according to the market equity criterion.

The second group (numbers 21-40) and the third group (numbers 41-60) are formed by ranking and partitioning firms on the basis of book-to-market equity and debt-to-market equity, respectively. All firms with negative annual earnings at the end of the last December are placed in portfolio 61, while all firms with positive cumulative annual earnings are placed in portfolio 62.

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[10]The standard errors of the estimates of the monthly cost of capital for the representative firm range from 0.3 percent to more than 1 percent over the sample period from August 1958 to December 1991.

[11]One could, in principle, derive the long-term cost of capital from the short-term cost of capital, the state variables, and their joint autocorrelation properties. The main results of this article would not be affected, however, if the joint autocorrelation properties of the state variables and the individual portfolio returns are similar across the portfolios that we later construct.

[12]See Fama and French, "The Cross Section of Expected Stock Returns."

[13]A firm that has issued a large amount of zero coupon long-term debt, for example, may not be burdened with high interest payments at present.

Box: Definitions and Sources of Data

Stock market returns and state variables

RRET: Value-weighted monthly New York Stock Exchange (NYSE) return (source: Center for Research in Securities Prices [CRSP]), less the monthly percentage change in the consumer price index (source: Bureau of Labor Statistics).

QUAL: Difference between the annualized bond-equivalent yields on Moody's Aaa-rated and Baa-rated corporate bonds (source: Citibase); monthly average of daily closing yields.

TERM: Difference between the annualized bond-equivalent yields of a ten-year Treasury bond and a three-month Treasury bill (source: Citibase); monthly average of daily closing yields.

INFL: Percentage change in the consumer price index over the preceding twelve months (source: Bureau of Labor Statistics).

DYLD: Cumulative dividends on the value-weighted NYSE over current and preceding eleven months (source: CRSP), divided by the current end-of-month value-weighted NYSE index.

TBIL: Annualized bond-equivalent yield of a three-month Treasury bill (source: Citibase); monthly average of daily closing yields.

Accounting variables

ME: Market value of equity defined as the price of stock multiplied by the number of shares outstanding (in millions of dollars, source: CRSP). Portfolio ln(ME) is the average $ln(ME_i)$ of all firms i in each portfolio. In the cross-sectional regressions of July of year t through June of year $t+1$, ME is the market equity at the end of June of year t. However, the twenty ME portfolios (numbers 1-20) for the same regressions are formed on the basis of each firm's market equity at the end of December of year $t-1$.

BE/ME: Ratio of book equity (BE) to market equity (ME). BE is defined as the book value of common equity plus balance-sheet deferred taxes in millions of dollars at the end of fiscal year $t-1$ (source: COMPUSTAT). ME is measured in millions of dollars at the end of December of year $t-1$. Portfolio ln(BE/ME) is constructed as the average $ln(BE_i/ME_i)$ across the firms in the portfolio. The year $t-1$ portfolio value of ln(BE/ME) is used in the cross-sectional regressions of July of year t through June of year $t+1$.

D/ME: Ratio of book value of debt (D) to market value of equity (ME). D is total value of book assets minus book equity for the fiscal year ending in calendar year $t-1$ (source: COMPUSTAT). ME is measured in millions of dollars at the end of December of year $t-1$. Portfolio ln(D/ME) is the average $ln(D_i/ME_i)$ across firms in the portfolio. The year $t-1$ portfolio value of ln(D/ME) is used in the cross-sectional regressions of July of year t through June of year $t+1$.

Portfolio formation

A. Portfolios 1-20, ranked annually by market value of equity, ME: All NYSE and American Stock Exchange (AMEX) firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on size. Size is measured by the market value of a firm's equity (ME) at the end of December of year $t-1$. . Portfolio 1 contains the smallest firms while portfolio 20 contains the largest firms. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal year from July of year t through June of year $t+1$.

B. Portfolios 21-40, ranked annually by book-to-market equity, BE/ME: All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on their book-to-market ratios, BE/ME. BE is the fiscal year $t-1$ COMPUSTAT value of a firm's common equity, and ME is the CRSP value of a firm's ME at the end of December of year $t-1$. Portfolio 21 contains firms with the smallest BE/ME, while portfolio 40 contains firms with the largest BE/ME. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal year from July of year t through June of year $t+1$.

C. Portfolios 41-60, ranked annually by debt-to-equity ratio, D/ME: All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC classification numbers 60-69—are equally divided into twenty portfolios of ascending order based on their book debt-to-market equity, D/ME. D is the year $t-1$ COMPUSTAT value of a firm's book assets minus common equity and ME is the CRSP value of market equity at the end of December of year $t-1$. Portfolio 41 contains firms with the lowest D/ME, while portfolio 60 contains firms with the highest D/ME. These portfolios are used in constructing equal-weighted portfolio returns for the fiscal

year from July of year t through June of year $t+1$.

D. *Portfolios 61-62, formed annually on the basis of negative or positive earnings:* All NYSE and AMEX firms in the cross section of the CRSP and COMPUSTAT tapes—excluding finance and real estate firms with two-digit SIC numbers 60-69—are divided into two portfolios

according to whether earnings are positive (portfolio 61) or negative (portfolio 62). Earnings are cumulative over the firm's fiscal year that ends in calendar year $t-1$, and are defined as income before extraordinary items plus income-statement deferred taxes minus preferred dividends (source: COMPUSTAT).

Financial firms (Standard Industrial Classification numbers 60-69) are excluded from the portfolios primarily because their accounting numbers do not have the same economic significance as those of nonfinancial firms.

The portfolio rankings on the basis of the four variables are repeated every December from 1962 to 1990. As a result, the composition of firms in each portfolio changes on a yearly basis, as it would in a mutual fund, but the relative quantitative characteristic common to the firms in the portfolio does not. Having formed the portfolios on the basis of each December's rankings, we then generate the corresponding portfolio returns for the following July-June period as the equal-weighted average of the returns to the stocks in the portfolio. Our procedure leads to sixty-two time series of portfolio returns, from July 1963 to December 1991. Each portfolio's return series can be thought of as the time series of returns associated with a mutual fund whose composition changes each July.[14]

The average market equity of a firm in portfolio 1 is about twelve-hundred times smaller than the corresponding value for a firm in portfolio 20 (Table 2, Panel A). The average ratio of book equity to market equity is 0.15 for the firms in portfolio 21 and rises by a factor of 22 to 3.33 for the firms in portfolio 40. The average ratio of debt to market equity is 0.05 for the firms in portfolio 41 and rises by a factor of 164 to 9.03 for the firms in portfolio 60.

Panel A of Table 2 provides evidence on the cross-section of the historical average real return performance of the extreme portfolios. The average monthly real return corresponds to the average unconditional cost of capital. Historically, a typical investor in an average small firm (portfolio 1), as well as a firm with high book-to-market equity (portfolio 40), a high leverage ratio (portfolio 60), or negative earnings (portfolio 61), has

demanded a higher expected return. Column 2 lists the cumulative real returns on a 1 dollar investment in each portfolio made in June 1963. The largest discrepancy in investment performance is between the largest market equity firms, which yielded roughly 3 dollars as of December 1991, and the smallest market equity firms, which yielded 197 dollars. These results are consistent with intuition: over time, marginal firms are riskier and consequently must offer a higher return in order to attract investors.

Evidence on the time-series behavior of the relative cost of capital
To trace the relative cost of capital over time and examine how it varies with economic conditions, we construct the expected returns on the portfolios by regressing each of the sixty-two time series of real returns on the lagged state variables described earlier. The size portfolios are considered first. Chart 2 plots the relative cost of capital of small firms. The relative cost of capital is constructed as the *difference* in the fitted values of the real returns between the smallest and largest market equity portfolios (portfolio 1 minus portfolio 20). Chart 2 demonstrates that the relative cost of capital of the smallest firms has a decidedly countercyclical component. It rises during a recession and invariably peaks at its trough. Generally, it declines over expansions, albeit not uniformly. To be sure, the large increase in 1986 was not associated with an official recession, but recession conditions existed in some geographic regions. Moreover, like the 1966 episode, 1986 was associated with a minor slowdown in business activity during the first half of the year; nomimal GNP of nonfinancial corporate business actually fell between the first and second quarters of 1986. Observe that the relative cost of capital was as large during the 1966 credit crunch as during the 1970 recession that followed. Neither episode was as significant as the 1975 or 1982 recession.

A string of negative relative costs of capital occurred during the early 1980s. On average, the 1980s differed from the 1960s and 1970s in this regard. Chart 2 sug-

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[14]The use of a six-month gap between the month in which the accounting variable is measured and the first month over which we calculate returns ensures that the accounting variables, which we take to represent risk, are in the information set of the investor.

gests that the relative cost of capital of small firms in the 1980s was lower than the historical standard. This finding may reflect investors' underestimation of fundamental risk during the early period of the boom or the effect of lower capital gains taxes.

Chart 3 plots the difference between the expected return on the extreme portfolios ranked by book-to-market equity. Specifically, the chart shows the difference in the regression fits between the highest and lowest book-to-market equity portfolios (portfolio 40 minus portfolio 21). Again, a cyclical pattern emerges, although in this case the severity of the 1966 episode is muted. Unlike the relative cost of the smallest market equity firms, the estimated relative cost of capital for the largest book-to-market equity firms is invariably positive. Book-to-market equity may be a better indicator of fundamental risk than the size of the firm: it captures expected future performance relative to past performance, and the expectation of poor performance may be associated with greater uncertainty about the firm's prospects.

Chart 4 plots the relative cost of capital of the most highly leveraged firms: the cost of capital for the largest debt-to-market equity firms minus the cost for the smallest debt-to-market equity firms (portfolio 60 minus portfolio 41). The series mimics the relative cost of capital for the smallest market equity firms plotted in Chart 2 and the largest book-to-market equity firms plotted in Chart 3.

In Charts 2-5, the recession that began in July 1990 also affected the cost of capital in the typical way. Although the rise in the relative cost of capital was as pronounced as in the 1966 and 1969 episodes, the duration of the rise was shorter. The unavailability of recent 1992 data prevents us from examining whether the relative cost of capital has subsequently risen further.[15]

Table 2

Portfolio Characteristics

July 1963-December 1991

Panel A: Relative Investment Performance of the Extreme Portfolios

	Average Monthly Real Return (Percent)	Cumulative Value in December 1991 of One Dollar Invested in June 1963 (Inflation Adjusted, in Dollars)
Extreme ME portfolios		
Lowest ME portfolio (1) with average ln(ME) = 1.18	1.96	197.66
Highest ME portfolio (20) with average ln(ME) = 8.30	0.44	3.17
Extreme BE/ME portfolios		
Lowest BE/ME portfolio (21) with average ln(BE/ME) = 1.89	0.44	2.15
Highest BE/ME portfolio (40) with average ln(BE/ME) = 1.19	1.19	67.15
Extreme D/ME portfolios		
Lowest D/ME portfolio (41) with average ln(D/ME) = −2.90	0.50	3.08
Highest D/ME portfolio (60) with average ln(D/ME) = 2.20	1.35	34.84
Negative earnings portfolio (61)	1.28	22.71
Positive earnings portfolio (62)	0.86	10.70

Panel B: Time Average of Cross-sectional Correlations of Portfolio Characteristics (Portfolios 1-62, July 1963-December 1991)

	r_j	$\hat{r}_j$	$\ln(ME)_j$	$\ln(BE/ME)_j$	$\ln(D/ME)_j$
r_j	1.0	0.16	−0.038	0.071	0.055
$\hat{r}_j$		1.0	−0.438	0.510	0.437
$\ln(ME)_j$			1.0	−0.560	−0.547
$\ln(BE/ME)_j$				1.0	0.880
$\ln(D/ME)_j$					1.0

Notes: The variable r is the real return of the portfolio; $\hat{r}$ is the fitted value of the real return. See the box for the definitions and descriptions of the other variables.

Cost of Capital for Firms with Low Market Equity minus Cost of Capital for Firms with High Market Equity

Monthly percent return
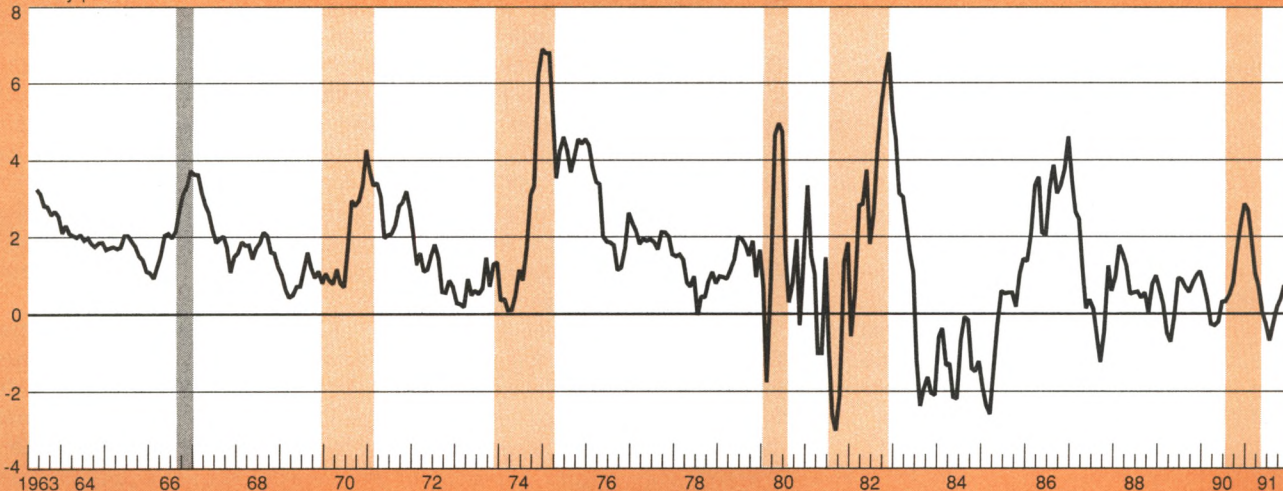
Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

Cost of Capital for Firms with High Book-to-Market Equity minus Cost of Capital for Firms with Low Book-to-Market Equity

Monthly percent return

Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

When Charts 2, 3, and 4 are considered collectively, the most striking feature is the nearly identical pattern in the relative costs of capital. In part, this shared pattern reflects the use of a common variable, the market value of equi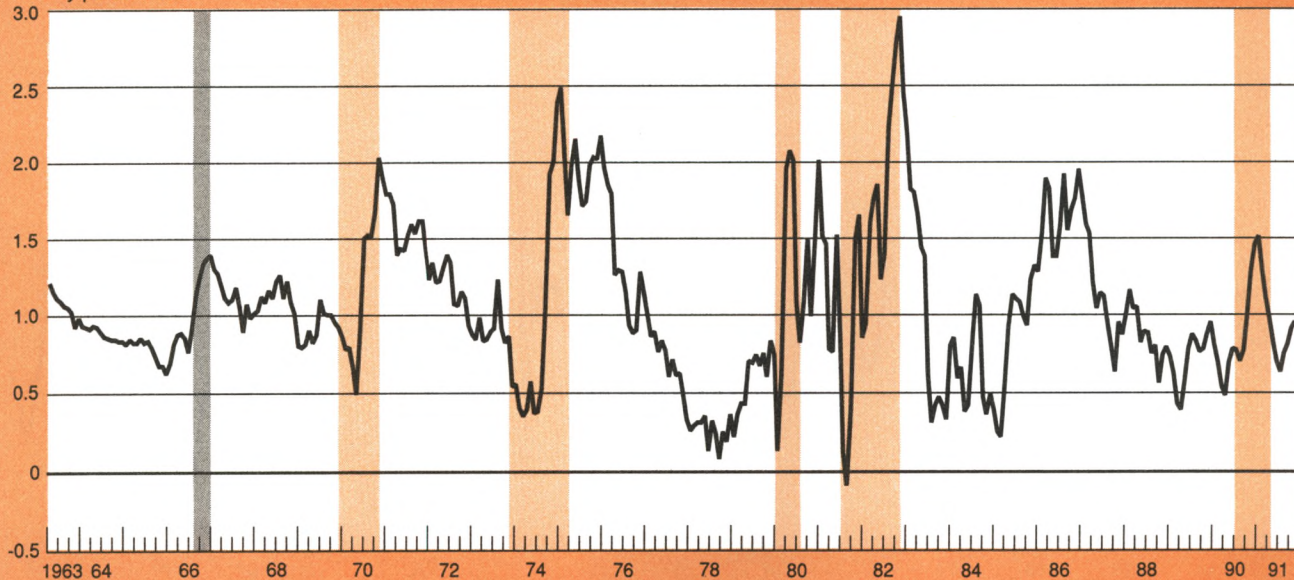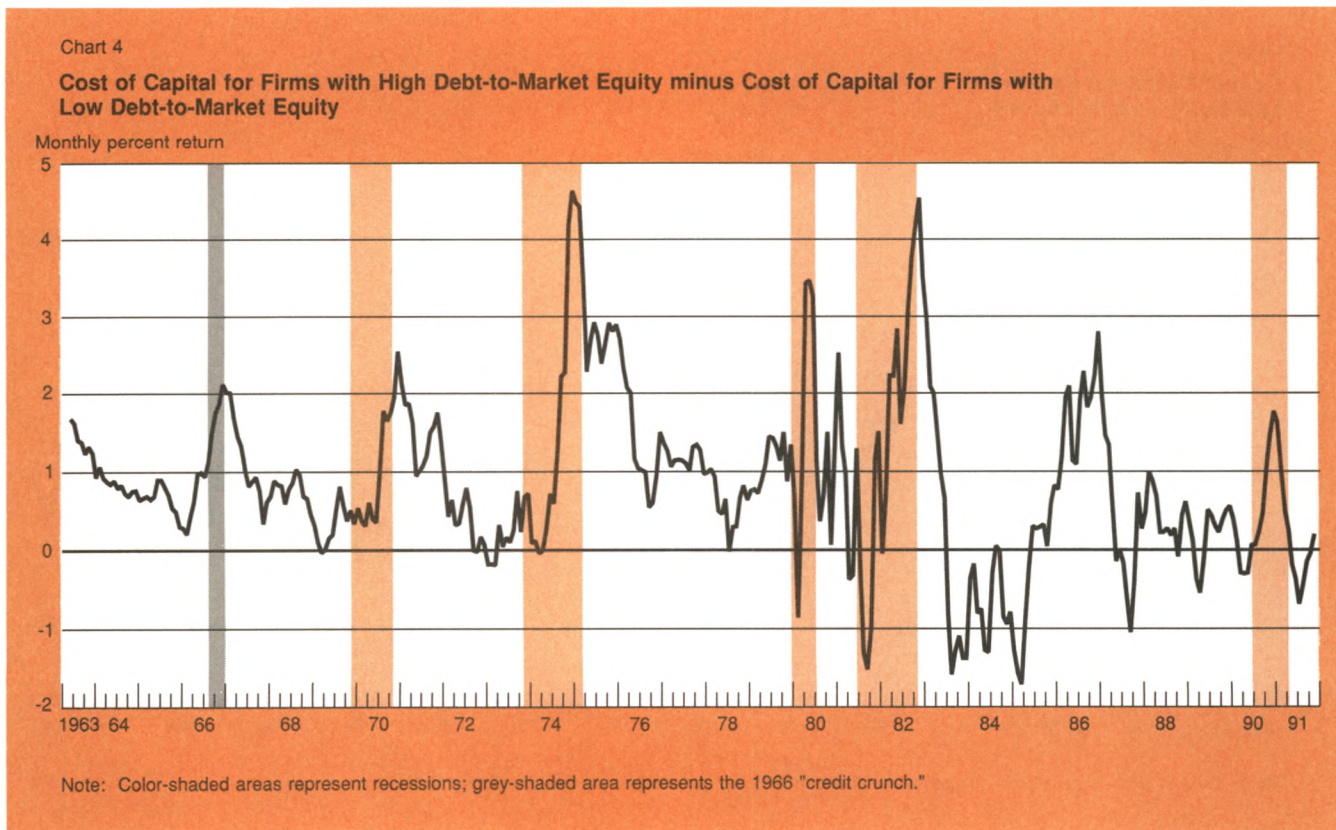ty in the measures of size, distress, and leverage. Nevertheless, the measures do impart independent information about the risk of a firm. Not all of the cross-sectional variation in the first risk factor, market equity, is explained using the other risk factors. In Panel B of Table 2, the average cross-sectional correlation of the log of book-to-market equity, ln(BE/ME), with the log market equity value, ln(ME), is -0.56, a result that implies a univariate R^2 of only 0.31. The cross-sectional correlation of the log debt-to-equity, ln(D/ME), with the log of market equity, ln(ME), is -0.55, implying a univariate R^2 of 0.30. The correlation between ln(BE/ME) and ln(DE/ME) across the sixty-two portfolios is somewhat higher at 0.88, implying a univariate R^2 of 0.77.

[15]In the charts, the recession that officially began in July 1990 ends in May 1991. But since May 1991 is not an official recesion trough, the 1990 recession is not considered in computing the peak-to-trough averages in the tables accompanying the text.

The relative cost of capital of "insolvent" firms is shown in Chart 5. The chart represents the expected return on the portfolio of firms having negative earnings (portfolio 61) minus the expected return for the portfolio of firms with positive earnings (portfolio 62). Although the sorting criterion for constructing these two portfolios makes no reference to each firm's market value of equity, the historical pattern of relative expected returns is similar to the pattern that emerged in the extreme portfolios' relative cost of capital when we used the other risk criteria. We conclude that the similar cyclical pattern produced in Charts 2 through 5 is not spurious; rather it represents common business cycle variation in the relative cost of capital for the "riskiest" of firms, however defined.

Panel A of Table 3 summarizes some of the main evidence from this section by tabulating the average trough-to-peak and peak-to-trough changes in the relative cost of capital depicted in Charts 2-5. The business cycle variation in the relative monthly ex ante rate of return is largest for the smallest market equity portfolio, declining from trough to peak by 366 basis points and then rising from peak to trough by 329 basis points. The

Chart 4

Cost of Capital for Firms with High Debt-to-Market Equity minus Cost of Capital for Firms with Low Debt-to-Market Equity

Monthly percent return

Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

business cycle variation in the monthly cost of equity capital for the largest book-to-market firms is less pronounced; it falls and then rises by 99 basis points over the full cycle.

The sensitivity of the cost of capital to the amount of risk

The evidence so far suggests that the cost of capital of the riskiest of firms fluctuates more than that of the safest firms over the business cycle, but it reveals little about the source of these relative changes. Differences between the required rates of return on the extreme portfolios may vary over time as a result of variations in either the "price" of risk—the sensitivity to size, leverage, and distress—or the relative quantity of risk— relative size, leverage, and distress. The price of risk may change as investors' attitudes toward risk change over the business cycle. The relative amount of risk may change if, for example, the leverage of the highly levered firms increases by more than that of the less levered firms during an economic downturn.
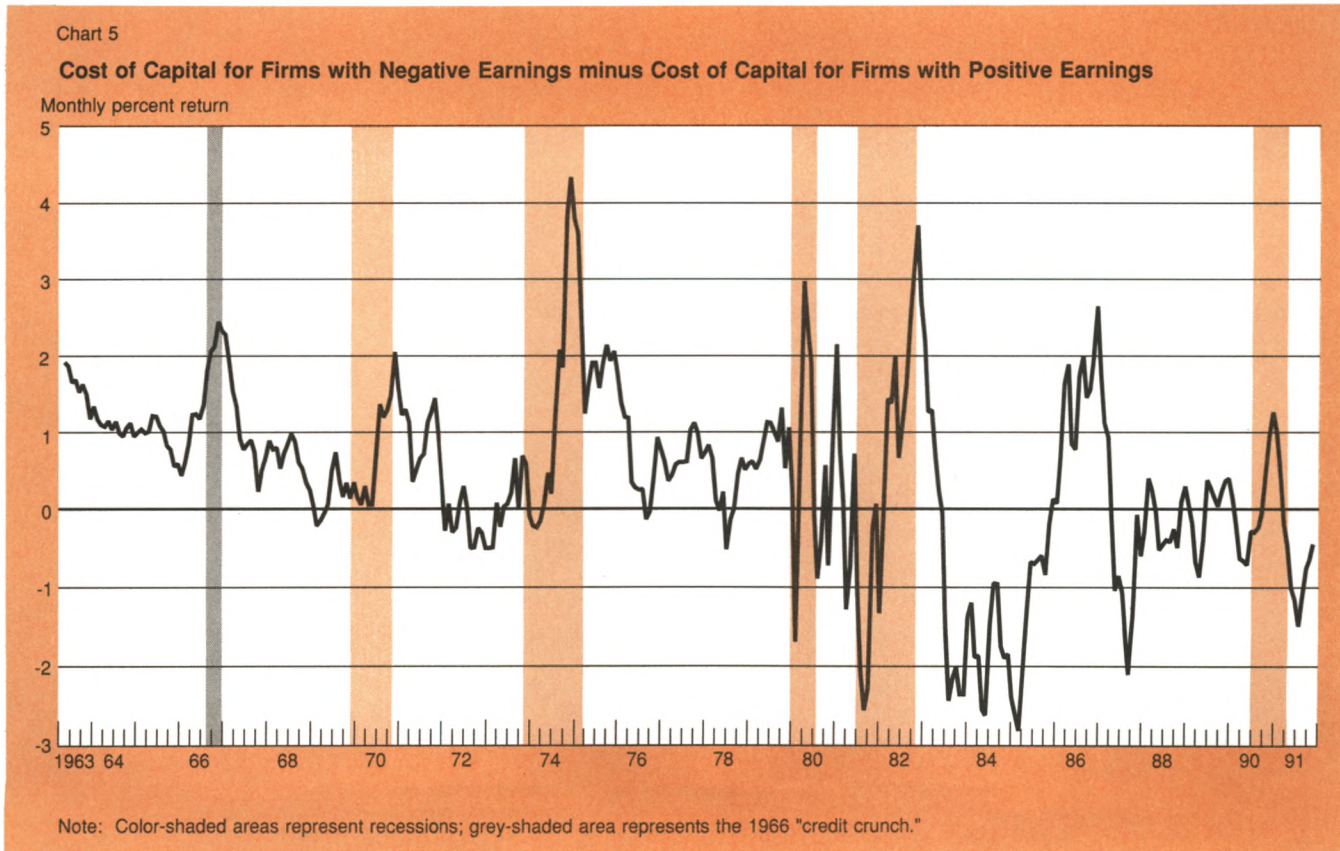
In this section we separate the price of risk from the quantity of risk by estimating the cross-sectional sensitivity of the cost of capital to our accounting measures of size, distress, and leverage. We trace the evolution of these sensitivities over business cycles. Such an exercise allows us to interpret the observed changes in the relative cost of capital more effectively. Furthermore, the analysis uses the entire cross-section of firm portfolios instead of the extreme portfolios.

We can think of the expected return for a firm j, or its cost of capital, as the sum of a risk-free rate and a risk premium. This risk premium is the product of the underlying price of risk and the amount of risk:

$$(3) \qquad E(r^e_{j,t+1}) = r^f(S_t) + \gamma(S_t) \times \sigma_j(S_t)$$

where $E(r^e_j)$ represents the expected return for firm (or portfolio) j, $\sigma_j(S_t)$ represents the amount of risk attached to j, and $\gamma(S_t)$ represents the price of risk or the sensitivity of the expected return to the amount of risk. The term $r^f(S_t)$ is constant across the portfolios but varies over time and reflects, among other things, the risk-free rate. Observe that the price of risk, $\gamma(S_t)$, is the same

Chart 5

Cost of Capital for Firms with Negative Earnings minus Cost of Capital for Firms with Positive Earnings

Monthly percent return

Note: Color-shaded areas represent recessions; grey-shaded area represents the 1966 "credit crunch."

across firms, reflecting a common sensitivity to the amount of risk, but can vary over time with the economic state, denoted by S_t. The quantity of risk, $\sigma_j(S_t)$, can vary both across firms and across time. Equation 3 is similar to equation 1, except that we have broken out the effect of the state variables on the price of risk from the effect on the amount of risk.

Equation 3 suggests a way of estimating the price of risk γ: each month, regress the cost of capital for a cross-section of twenty portfolios on measures that serve as proxies for the underlying risks, specifically on the natural logarithms of ME, BE/ME, and D/ME.[16] The cross-sectional regressions have the form:

$$\hat{r}_j^e = \alpha + \gamma_{ME} \times ln(ME)_j \qquad j = 1,\ldots,20$$
$$\hat{r}_j^e = \beta + \gamma_{BE/ME} \times ln(BE/ME)_j \qquad j = 21,\ldots,40$$
$$\hat{r}_j^e = \delta + \gamma_{D/ME} \times ln(D/ME)_j \qquad j = 41,\ldots,60$$

[16]Fama and French ("The Cross Section of Expected Stock Returns") suggest that using the log transformation of ME, BE/ME, and

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Table 3

Changes in the Relative Cost of Capital of Small, Distressed, and Leveraged Firms over the Business Cycle
July 1963-December 1991

Change in:	Change from Trough to Peak (Average across Five Recoveries, in Percent)	Change from Peak to Trough (Average across Five Recessions, in Percent)
Lowest ME portfolio minus highest ME portfolio (1 minus 20)	−3.66	3.29
Highest BE/ME portfolio minus lowest BE/ME portfolio (40 minus 21)	−0.99	0.99
Highest D/ME portfolio minus lowest D/ME portfolio (60 minus 41)	−2.35	2.12
Negative earnings portfolio minus positive earnings portfolio (61 minus 62)	−2.08	1.75

Notes: Construction of variables is described in the box. Peaks and troughs correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: December 1966, November 1970, March 1975, July 1980, and November 1982.

Table 4

The Average Cross-sectional Sensitivity of the Cost of Capital to Market Equity, Book-to-Market Equity, and Debt-to-Market Equity
July 1963-December 1991

Panel A: Twenty Portfolios Ranked Annually by Value of Market Equity

$$\hat{r}_i = 1.485 - 0.150 \ ln(ME)_i; \qquad R^2 = 0.550$$
$$(0.178) \quad (0.013) \qquad\qquad (0.017)$$
$$j = 1, 2,\ldots,20$$

Panel B: Twenty Portfolios Ranked Annually by Ratio of Book Equity to Market Equity

$$\hat{r}_i = 0.931 + 0.387 \ ln(BE/ME)_i; \quad R^2 = 0.504$$
$$(0.112) \quad (0.009) \qquad\qquad (0.012)$$
$$i = 21, 22,\ldots, 40$$

Panel C: Twenty Portfolios Ranked Annually by Ratio of Debt to Market Equity

$$\hat{r}_i = 0.845 + 0.140 \ ln(D/ME)_i; \qquad R^2 = 0.279$$
$$(0.112) \quad (0.009) \qquad\qquad (0.011)$$
$$i = 41, 42,\ldots, 60$$

Notes: A cross-sectional regression is performed in each of the 342 months of the sample. The reported coefficients and R²s are the time series averages of the cross-sectional values. Inside the parentheses are the standard errors based on the *time-series* variability of the cross-sectional estimates. The variable $\hat{r}_i$ is portfolio j's cost of capital in percent per month, computed from the time series regression of the form in equation 2. The accounting variables are described in the box.

where the $\hat{r}_j^e$ are the fitted values from the sixty time series regressions of the portfolio returns on the macroeconomic state variables. Each equation is estimated for each month from July 1963 to December 1991 to obtain a time series of coefficient estimates, $\{\gamma_{ME}\}$, $\{\gamma_{BE/ME}\}$, and $\{\gamma_{D/ME}\}$.[17]

The time series averages of the coefficient estimates, $\bar{\gamma}_{ME}$, $\bar{\gamma}_{BE/ME}$, and $\bar{\gamma}_{D/ME}$, appear in Table 4. These coefficients represent the "prices," expressed as semi-elasticities, attached to each dimension of risk measured by $ln(ME)$, $ln(ME/BE)$, and $ln(ME/A)$, respectively. The estimated $\bar{\gamma}_{ME}$ tells us that on average the expected monthly return (cost of capital) increases by 0.15 percent—15 basis points—as we decrease the market value of the firm by 1 percent. The estimated $\bar{\gamma}_{BE/ME}$ indicates that on average the cost of capital increases by 39 basis points as book-to-market equity increases by 1 percent. Finally, the estimated $\bar{\gamma}_{D/ME}$ implies that on average the cost of capital increases by 14 basis points as the debt-to-equity ratio increases by 1 percent. Although it is difficult to interpret the relative magnitudes of these numbers, the standard errors attached to the estimates suggest that they are estimated quite precisely.

How does the price of risk change over the business cycle? Panel A of Table 5 displays the average peak and trough values of the price of risk, with risk measured by our three criteria. At business cycle peaks,

Footnote 16 continued
DE/ME provides a better specification of the relationship between these variables and average expected returns.

[17]The estimated γ's remain approximately the same if, instead of the cost of capital $\hat{r}_j^e$, we use the raw return, r_j^e, as the dependent variable.

investors require an additional 3 basis points in the expected monthly return to bear the risk of an additional 1 percentage point decline in the market value of a firm's equity. At recession troughs, however, a similar decrease in the value of a firm is associated with an additional 54 basis points in the monthly required return. In other words, investors have become more averse to size-related risk over the course of a recession. The other price-of-risk measures move similarly over the business cycle.

Conclusion
This article uses the expected rate of return on a firm's stock as a measure of the firm's cost of capital. To estimate the expected rate of return, we regress the realized real stock return of the firm on a parsimonious set of financial variables. The regression fit is a proxy for the firm's expected monthly rate of return, or its short-run cost of capital. The short-run cost of capital affects a firm's decision to postpone a capital project and is also related to the long-term cost of capital if the short-run required rates of return show some persistence.

The weight of evidence suggests that the business cycle has a differential impact on the costs of capital of firms grouped by size, distress, and financial leverage. From peak to trough of a recession, the premium in the cost of capital for the smallest over the largest firms—what we call the relative cost of capital—increases by 329 basis points on a monthly basis. From trough to peak of an expansion, the same premium declines by 366 basis points. Similar variations in the relative cost of capital are observed when firms are grouped according to other characteristics. For example, the premium

Table 5

The Cross-sectional Sensitivity of the Cost of Capital to Market Equity, Book-to-Market Equity, and Debt-to-Market Equity over the Business Cycle
July 1963-December 1991

| | Sensitivity at Cyclical Peaks and Troughs | |
Semi-elasticities	Average of Six Peak Months	Average of Five Trough Months
Semi-elasticity of expected return with respect to ME	−0.03	−0.54
Semi-elasticity of expected return with respect to BE/ME	0.40	0.46
Semi-elasticity of expected return with respect to D/ME	0.10	0.33

Notes: Construction of variables is described in the box. Peaks and troughs correspond to National Bureau of Economic Research reference cycles plus the 1966 credit crunch. Dates of peaks are: August 1966, December 1969, November 1973, January 1980, July 1981, and July 1990. Dates of troughs are: December 1966, November 1970, March 1975, July 1980, and November 1982.

of firms with negative earnings increases from peak to trough by 175 basis points and decreases from trough to peak by 205 basis points.

The change in the marginal firms' relative monthly cost of capital is attributable in part to a change in the cross-sectional sensitivity of the cost of capital to each of the three characteristics—market value, book-to-market equity, debt-to-equity ratio—used as proxies for risk in this study. This sensitivity can be thought of as the price of risk, with the quantity of risk captured by the accounting variables. At business cycle peaks, a 1 percent increase in market equity leads to an average reduction in the cost of capital of 3 basis points. At business cycle troughs, however, a 1 percent increase in market value elicits a 54 basis point reduction in the cost of capital. The positive elasticity of the cost of capital to the debt-to-equity ratio also varies considerably across the cycle, rising threefold from peak to trough. The sensitivity of the cost of capital to book-to-market equity follows a similar pattern, although its variability is less pronounced.

Our regressions indicate that the asymmetric effects of the business cycle on marginal firms' cost of capital are not trivial. Therefore, it is appropriate to consider the broader economic consequences of these effects. First, such effects may be an important element in the propagatation and duration of the business cycle. A sharp increase in the cost of capital to small, highly leveraged, or distressed firms could transform a decline in aggregate demand or some other shock to economic activity into a downturn large enough to be judged a recession. Second, the differential effect of the business cycle upon the cost of capital may influence industrial structure by promoting merger activity. Small, distressed, or highly levered firms that wish to overcome a competitive disadvantage in the market for capital during recessions may seek to merge so as to achieve a lower cost of capital. Such possible repercussions should prompt economists to look more closely at this issue.

The Impact of the Current Defense Build-down

by Ronnie Lowenstein and Richard Peach

For the third time since the end of World War II, the United States is engaged in a long-term defense build-down. Through fiscal 1992, real defense outlays have been reduced by 11 percent from their 1987 level, a decline equal to 1.1 percent of real GDP. Under the Bush Administration's fiscal 1993 budget submission to the Congress, real defense outlays would continue to decline through fiscal 1997, producing cumulative reductions of 28 percent or $80 billion in 1987 dollars. Under this scenario, real defense spending would decline from 6.3 percent of GDP in 1987 to 3.6 percent by 1997, the lowest share of total output in the entire post-World War II period.

Considerably deeper cuts have been advocated and cannot be ruled out. For example, the fiscal 1993 defense appropriations approved by Congress provide defense budget authority of $274 billion, $7 billion less than originally requested by the President. Pressure for cutting defense spending will likely intensify during the fiscal 1994 budget cycle as the discretionary spending caps of the Budget Enforcement Act of 1990 become more binding while the "fire wall" between defense and nondefense discretionary spending is removed.

In the long run, the economy is likely to benefit from lower defense spending as resources are released for more productive uses. However, considerable short-run pain will accompany the transition. Since 1987, employment in defense-related industries has declined by roughly 440,000, while the number of active duty military personnel has fallen by 300,000 and Department of Defense civilian employees have declined by 100,000. These workers, many of whom had high-skill, high-wage jobs, are being displaced into a relatively weak labor market.

This article provides a broad overview of the current defense build-down.[1] In the first section, aggregate statistics are used to compare this build-down with earlier build-downs of the post-World War II period. The second section assesses the size of the "peace dividend"; the third considers the contribution of the build-down to the current lackluster state of the economy. Finally, regional and industry-level effects are reviewed.

The current defense build-down in perspective

Since the build-down following the end of World War II, U.S. defense spending has gone through three long cycles associated with the Korean War, the Vietnam War, and the Carter-Reagan defense buildup, hereafter termed the "Cold War" (Chart 1). The build-down phase of the Cold War cycle began with the passage of the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm-Rudman-Hollings I). But it was not until fiscal 1987 that actual real defense outlays as a percent of GDP peaked and the reversal got under way.[2] By fiscal 1997 real defense outlays are likely to be 28 to 38 percent below the 1987 level, while total defense-

[1]Much of the backround work for this article was done by Ethan Harris, Paul Ludwig, and Cynthia Silverio.

[2]In this article, fiscal 1987 is the peak in the Cold War defense spending cycle because constant dollar defense outlays (measured on a unified budget basis) as a percent of real GDP peaked in that year. However, the absolute level of constant dollar defense outlays peaked in fiscal 1989.

related employment is expected to decline by 2.0 million to 2.6 million. Although large in absolute terms, the Cold War defense build-down has been and is expected to continue to be considerably smaller as a percentage of GDP and as a percentage of total employment than both the Korean War build-down and the Vietnam War build-down. However, for reasons discussed below, the absolute decline in employment in the private sector defense industry is expected to be comparable to that which occurred during the Vietnam War build-down.

Table 1 provides data on real defense outlays and total defense-related employment for the current and previous two build-downs.[3] For the current build-down, information is presented to date and projected through 1997. The projections are based on two scenarios that we assume to be the likely upper and lower bounds of

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[3]Total defense-related employment consists of active duty military personnel, including full-time reserves and national guard; civilian employees of the Department of Defense (DoD); and defense industry employees as defined by the DoD. The DoD series on defense industry employment covers employment devoted to fulfilling direct and indirect DoD contracts (prime contractors and subcontractors) in all industries that have such contracts. The DoD series is broader in scope than the defense-related employment series published by the Bureau of Labor Statistics because the latter series covers only industries in which defense-related production represents 50 percent or more of total output.

Chart 1

Real Defense Outlays

Sources: Office of Management and Budget, *Mid-Session Review: The President's Budget and Economic Growth Agenda,* July 1992; Defense Budget Project.

Note: Outlays are measured on a fiscal year, unified budget basis.
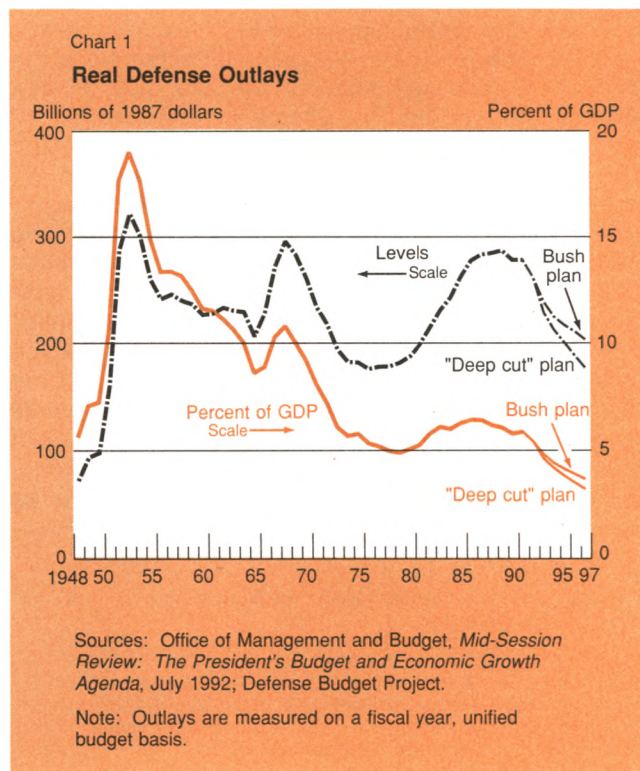
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defense spending over the next five years. The upper bound (lower defense cuts) is the path proposed in the Bush Administration's fiscal 1993 budget. Under that scenario, real defense outlays decline a cumulative 28 percent from fiscal 1987 to fiscal 1997 and represent 3.6 percent of real GDP at the end of that period. The lower bound (greater defense cuts) is the "deep cut" plan compiled (but not specifically endorsed) by the nonpartisan Defense Budget Project.[4] Under that scenario, real defense outlays are reduced a total of 38 percent and represent 3.1 percent of GDP by fiscal 1997. The decline in total defense-related employment over the fiscal 1987-97 period also varies with the scenario: 2.0 million under the Bush plan and 2.6 million under the deep cut plan.

To date, the Cold War build-down has been quite modest. Through fiscal 1992, real defense outlays are down 11 percent, or 1.1 percent of GDP, while total defense-related employment is down 12.8 percent, or 1.1 percent of total nonagricultural employment. Five years into the Vietnam War build-down, defense outlays were down the equivalent of 4.7 percent of GDP and the decline in defense employment equaled 5.0 percent of total employment. For the first five years of the Korean War build-down, comparable figures were 5.9 percent and 5.3 percent, respectively.

Assuming that fiscal 1997 is the trough of the current build-down, the total peak-to-trough decline in defense outlays is expected to be in the range of 28 to 38 percent, compared with an average of 38 percent for the previous two build-downs. But because of a secular decline in the importance of defense spending to the U.S. economy, the projected declines in defense outlays represent just 2¾ to 3¼ percent of GDP, compared with 5.9 percent after the Vietnam War and 10.5 percent after the Korean War. A comparably smaller effect prevails for total defense-related employment.

While relatively smaller, the aggregate statistics may understate the difficulty of the current adjustment to lower defense spending. The Cold War build-down has been oriented more toward reducing the procurement of weapons produced by private sector defense contractors than toward decreasing troop strength. As shown in Chart 2, from fiscal 1987 to fiscal 1997, procurement outlays are expected to decline by about $38 billion in constant dollars, accounting for nearly half of the total decline in defense spending; thus far, most of the reduction in defense outlays has occurred in procure-

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[4]The "deep cut" option is a compilation of numerous defense spending proposals advanced by members of Congress and private groups, many of which advocate even greater reductions of defense outlays. The Defense Budget Project, a nonpartisan, privately-funded research group, does not endorse any specific defense spending proposals.

ment. This decline in procurement spending is similar to the one during the Vietnam War build-down.[5] Reflecting the fall in procurement spending, defense industry employment will decline substantially over the fiscal 1987-97 period. Although this decline in defense industry employment is smaller than that during the Korean War build-down, it is roughly comparable in size to that during the Vietnam War build-down (Table 2).

The peace dividend
The Cold War build-down will free a substantial amount of resources that can be applied to other public and private pursuits. The size of the "peace dividend" is not an unambiguous issue, however; it depends on what baseline and what prospective cuts one assumes. Shown in Chart 3 are the peace dividends resulting from the three post-World War II build-downs, calculated as the difference between peak year and trough year defense outlays measured in constant dollars and as a percent of real GDP. In constant dollar terms the

Cold War dividend ranges from $80 billion under the Bush plan to $107 billion under the deep cut plan. The analogous amounts following the Korean and Vietnam Wars were $116 billion and $114 billion, respectively. As noted above, while roughly comparable in dollar terms, the projected Cold War peace dividend is expected to be only about 2¾ to 3¼ percent of GDP, compared with 10.5 percent after the Korean War and 5.9 percent after the Vietnam War. With the federal deficit currently at nearly 5 percent of GDP, the peace dividend would be only a partial solution to our deficit problem even if the entire amount were applied to that purpose.

The cyclical impacts of the build-downs
All three defense build-downs have coincided with periods of relatively slow overall economic growth during which the economy slipped into recession. While steep cuts in defense outlays have contributed significantly to slowdowns in the past, that does not appear to be the case during the current build-down. By a quirk of fate, defense spending was a modest plus for the economy during the recession from 1990-III to 1991-I. And

[5]Comparable data for the Korean War build-down (1953-65) are unavailable.

Table 1

Major Periods of Decline in Defense Spending and Employment

	Real Defense Spending[†] (Billions of 1987 Dollars)	Share of Real GDP (Percent)	Total Defense-related Employment (Thousands)	Share of Total Nonagricultural Employment (Percent)
Korean War build-down				
1953	322.1	19.0	8,977	17.9
1958	239.7	13.1	6,469	12.6
1965	206.5	8.5	5,767	9.4
Percent drop 1953-65	−35.9	−10.5[‡]	−35.8	−8.5[‡]
Vietnam War build-down				
1968	295.8	10.7	7,955	11.6
1973	194.0	6.0	5,100	6.6
1979	181.6	4.8	4,807	5.3
Percent drop 1968-79	−38.6	−5.9[‡]	−39.6	−6.3[‡]
Cold War build-down				
To date:				
1987	283.1	6.3	6,657	6.5
1992	252.1	5.2	5,802	5.4
Percent drop 1987-92	−11.0	−1.1[‡]	−12.8	−1.1[‡]
Projected:				
Bush plan 1997	203.3	3.6	4,650	3.9
Percent drop 1987-97	−28.2	−2.7[‡]	−30.1	−2.6[‡]
Deep cut plan 1997	176.6	3.1	4,040	3.3
Percent drop 1987-97	−37.6	−3.2[‡]	−39.3	−3.2[‡]

Sources: Federal Reserve Bank of New York; Defense Budget Project; U.S. Department of Defense; Office of Management and Budget, *Mid-Session Review: The President's Budget and Economic Growth Agenda*, July 1992.

Note: All years shown are fiscal years.
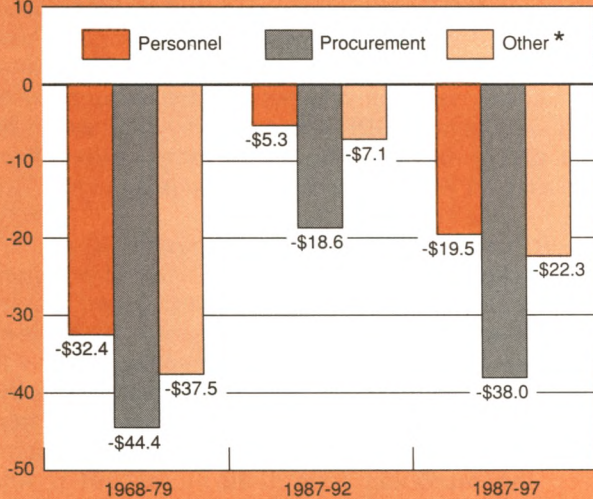[†]As measured on a unified budget basis.
[‡]Percentage point decline.

Chart 2

Changes in Constant Dollar Defense Outlays by Category

Billions of 1987 dollars

Legend: Personnel | Procurement | Other *

Values shown:
- 1968-79: Personnel −$32.4, Procurement −$44.4, Other −$37.5
- 1987-92: Personnel −$5.3, Procurement −$18.6, Other −$7.1
- 1987-97: Personnel −$19.5, Procurement −$38.0, Other −$22.3

Source: *Budget of the United States Government,* fiscal year 1993.

Note: Estimates for fiscal years 1992-97 assume the enactment of the Bush fiscal year 1993 budget plan.

* "Other" comprises operations and maintenance, research and development, military construction, family housing, atomic energy defense activities, and all other defense activities.

available evidence suggests that the decline in defense outlays since fiscal 1987 has played only a minor role in the below-potential growth that has prevailed since 1989.

During the Korean War build-down, a recession lasting three quarters began in the final quarter of 1953, followed by a slow recovery and another three-quarter recession beginning in late 1957. During the Vietnam War build-down, the economy was in recession from the end of 1969 to the end of 1970 and then again from late 1973 through early 1975. Table 3 presents the contribution of real defense spending to overall economic growth around the troughs of these and other business cycles since the end of World War II.[6] (We consider 1991-I the trough of the most recent recession. The brief and unusual downturn of 1980 is omitted.) During the four quarters up to and including the trough quarter, real defense outlays sometimes contributed to and sometimes offset declines elsewhere in the economy. The largest negative contributions occurred during the 1953-54 recession—minus 1.9 percentage points—and during the 1970 recession—minus 1.1 percentage points. Both of these recessions occurred during the first five years of the previous two build-downs. On average, real defense spending subtracted 0.3 percentage points from growth during the previous seven

[6]The contribution-to-growth measures referred to in this section represent the direct contribution of changes in defense spending to overall economic growth. The indirect or multiplier effects are not included.

Table 2

Declines in Defense-related Employment during Defense Build-downs

	1953-65	1968-79	1987-97†	Memo: 1987-92
Total defense-related employment (thousands)	3,210	3,148	2,007	855
Percent of total change	100.0	100.0	100.0	100.0
Defense industry employment (thousands)	1,993	1,314	1,171	440
Percent of total change	62.1	41.7	58.3	51.5
Troop strength and Department of Defense civilian employees (thousands)‡	1,217	1,834	836	415
Percent of total change	37.9	58.3	41.7	48.5

Sources: Federal Reserve Bank of New York; Defense Budget Project; U.S. Department of Defense; Office of Management and Budget, *Mid-Session Review: The President's Budget and Economic Growth Agenda,* July 1992.

Note: All years shown are fiscal years.
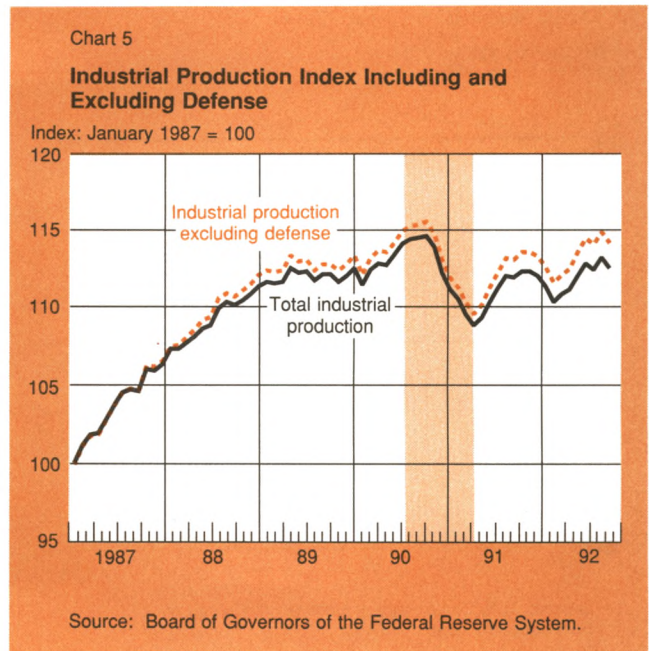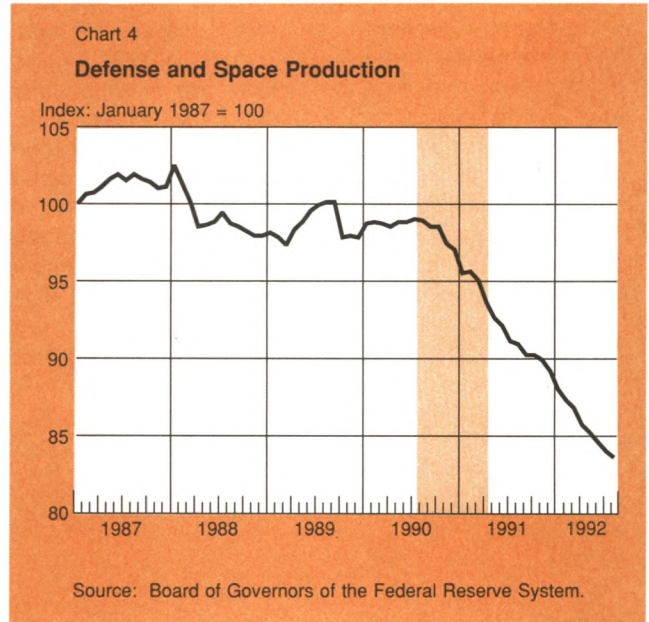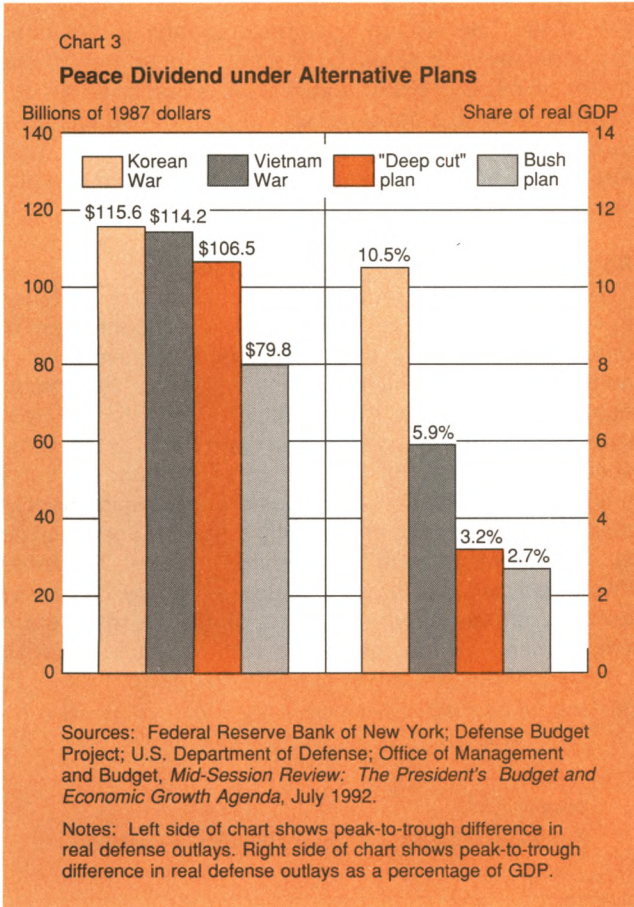
†Estimate for 1987-97 is based on the Bush plan.

‡Troops include full-time reserves and the national guard. Department of Defense civilian employees are a direct hire work force that includes both U.S. and foreign nationals.

recessions. During the most recent recession, defense spending was actually a small plus for the economy because of the temporary upturn in defense outlays associated with the conflict in the Persian Gulf.

During the recovery period from 1991-I to 1992-II defense spending *reduced* real GDP growth by 0.5 percentage points. During the five quarters after the trough of past business cycles, defense outlays *contributed* an average of 0.4 percentage points to growth.

The current defense build-down is often cited as one

Chart 3
Peace Dividend under Alternative Plans

Billions of 1987 dollars   Share of real GDP

Legend: Korean War, Vietnam War, "Deep cut" plan, Bush plan

Values shown: $115.6, $114.2, $106.5, $79.8, 10.5%, 5.9%, 3.2%, 2.7%

Sources: Federal Reserve Bank of New York; Defense Budget Project; U.S. Department of Defense; Office of Management and Budget, *Mid-Session Review: The President's Budget and Economic Growth Agenda*, July 1992.

Notes: Left side of chart shows peak-to-trough difference in real defense outlays. Right side of chart shows peak-to-trough difference in real defense outlays as a percentage of GDP.

Chart 4
Defense and Space Production

Index: January 1987 = 100

Source: Board of Governors of the Federal Reserve System.

Table 3
Contribution of Real Defense Spending to Real GDP Changes around Cyclical Troughs

Date of Recession's Trough	Four Quarters to Trough Quarter	Five Quarters after Trough Quarter
1949-IV	0.1	4.2
1954-II	−1.9	−1.2
1958-II	−0.1	−0.7
1961-I	0.2	0.6
1970-IV	−1.1	−0.5
1975-I	0.0	−0.1
1982-IV	0.5	0.3
Average	−0.3	0.4
1991-I	0.1	−0.5

Chart 5
Industrial Production Index Including and Excluding Defense

Index: January 1987 = 100

Industrial production excluding defense

Total industrial production

Source: Board of Governors of the Federal Reserve System.

of the structural impediments that has restrained growth since 1989. As Chart 4 indicates, production of defense-related goods has been on a downward trend since 1987, with a particularly steep drop since mid-1990. The recent pattern of overall industrial production, however, is essentially the same whether defense is included or excluded (Chart 5).

To assess more fully the contribution of defense spending to the current state of the economy, we used an econometric model to construct a "never-cut" baseline for the period from fiscal 1987 to fiscal 1992.[7] Under this baseline, real defense outlays are maintained at their 1987-III level. Chart 6 presents the actual path of real defense outlays relative to this never-cut baseline. From 1987-III to 1989-I, real defense outlays declined a little over 6 percent. However, from 1989-I to 1990-III, defense outlays held steady at between 4 and 6 percent below the baseline level. Then, in response to events in the Persian Gulf, outlays from 1990-III to 1991-I increased to just 2 percent under the baseline. Thereafter, defense spending declined sharply, to about 89

[7]The Data Resources Inc. model was used to create this historical simulation. In addition to keeping real defense outlays at the 1987-III level, we assumed monetary policy to be neutral by holding M2 at actual levels. The additional defense spending was assumed to be financed with additional government borrowing.
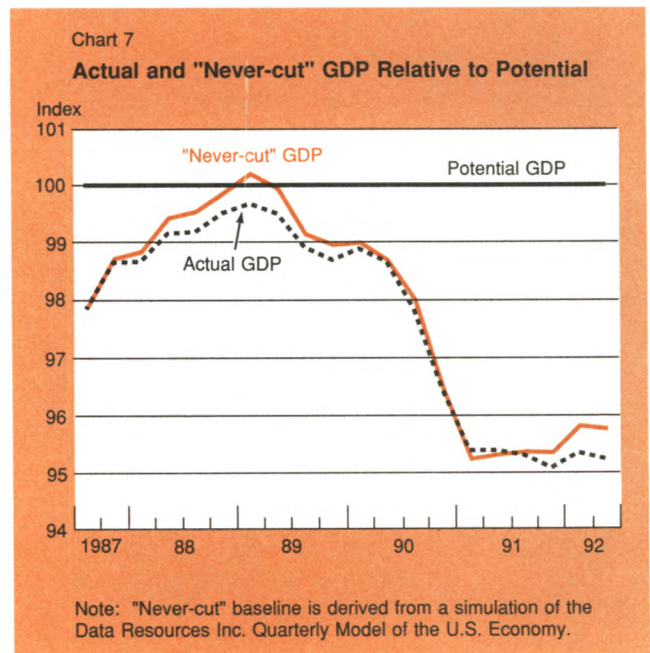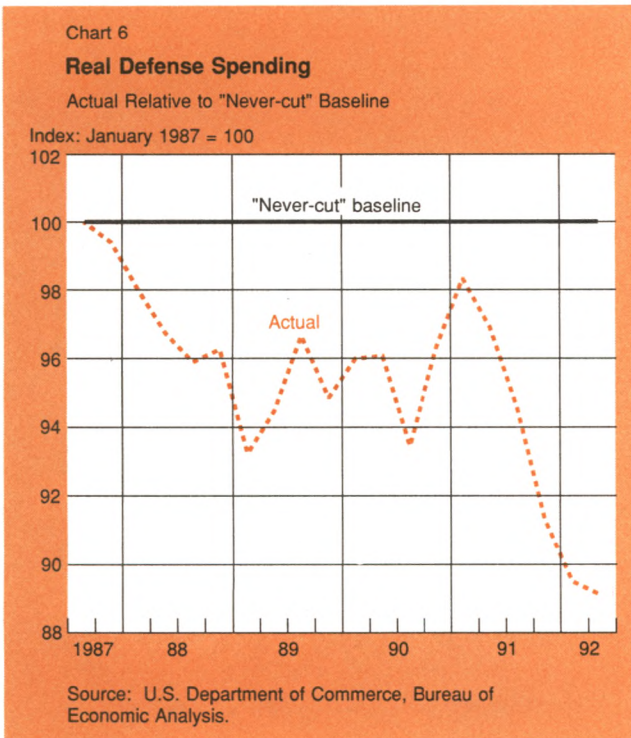
percent of the baseline level by 1992-II.

Chart 7 presents the actual and never-cut baseline levels of real GDP relative to potential GDP over this period. These results suggest that through 1989 the cuts in defense spending depressed the level of real GDP by only modest amounts. During 1990 and the first half of 1991, the upturn in defense spending stimulated the economy, with actual GDP equal to or slightly above the baseline. By 1992-II actual GDP is just one-half of 1 percent below the baseline. Of the 5 percent cumulative gap between actual and potential GDP by 1992-II, only about 10 percent is explained by the defense build-down.

Regional and industry-level effects

Although the macroeconomic impact of the defense build-down is relatively modest, the concentration of defense employment and output in a relatively small number of states and industries will make the microeconomic transition more difficult. Just ten states, located primarily in the Northeast and Far West regions, account for nearly 60 percent of all defense industry employment (Table 4).[8] A state's defense employment in absolute terms is not necessarily a good measure of its economic dependence on defense, however. The more diversified and the larger a state's economy, the lower its defense employment as a share of total state employment. Of the ten states with the most defense

[8]The analysis does not include Department of Defense personnel.

Chart 6

Real Defense Spending

Actual Relative to "Never-cut" Baseline

Index: January 1987 = 100

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Chart 7

Actual and "Never-cut" GDP Relative to Potential

Note: "Never-cut" baseline is derived from a simulation of the Data Resources Inc. Quarterly Model of the U.S. Economy.

industry employment, only four—Connecticut, Virginia, Massachusetts, and California—have economies that depend heavily on defense.

Not surprisingly, the largest labor force effects of defense cuts occur in those states with the largest defense output.[9] California has experienced the greatest defense employment declines, losing roughly 75,000 defense jobs between fiscal 1988 and fiscal 1992. Under the Bush fiscal 1993 budget, California is projected to lose 38,300 additional defense jobs in fiscal 1993 and a total of 124,000 defense jobs over the next five years.[10] Job losses under the deep cut option would be roughly 38 percent greater, amounting to a total of about 171,000 defense jobs over the next five years.

Defense production in California is concentrated in the aerospace, electronics, and communications industries. The manufacture of aircraft and missiles, includ-

ing engines and parts, accounted for nearly half of the dollar value of fiscal 1991 prime contracts awarded in California.[11] California's missile industry, which depends on domestic defense for 80 percent of its sales, has been particularly hard hit. Although California's aircraft industries are less heavily defense-dependent, relying on the Pentagon for roughly 60 percent of sales, strong growth in civilian and foreign defense demand has not been sufficient to offset declining sales to the Pentagon. California's communications and electronics industries have fared better thus far in the builddown, in part because defense makes up only 36 percent and 23 percent, respectively, of these industries' sales nationwide (Table 5). Moreover, the emphasis of recent Pentagon budgets on developing new weapons and upgrading existing systems has meant that defense demand for communications and electronics equipment has not fallen as steeply as defense demand for other procurement categories.

The list of the most severely affected states changes when defense industry declines are considered relative to the size of each state's economy (Table 6). Under this criterion, Connecticut suffered the worst declines, losing 1.3 percent of total employment between fiscal 1988 and fiscal 1992. Defense industry cuts cost Massachusetts and Missouri each 0.9 percent of employment over the same period. Connecticut remains the most heavily

[9]Our estimates of defense industry employment declines for fiscal years 1988-91 are based on the distribution of prime contract awards. Projections for fiscal 1992 and beyond are by the Defense Budget Project and are based on the assumption that cuts in any one category of defense spending will affect each state in proportion to its employment in that category. In reality, of course, the impact of reduced defense spending on each state will depend on the specific programs and facilities cut.

[10]The largest labor market effects for all states under either the current budget or the deep cut option are projected to occur in fiscal 1993. The severity of the fiscal 1993 effects is due in part to the winding down of outlays associated with Operation Desert Storm.

[11]State of California, Commission on State Finance, "Impact of Defense Cuts on California," Fall 1992.

Table 4

Defense Industry Employment Declines:
States with Largest Cuts in Absolute Terms
Thousands of Employees

| State | Total Fiscal 1992 Defense Employment | Cumulative Cuts Fiscal 1988-92 | Bush Fiscal 1993 Budget | | Deep Cut Option | |
			Fiscal 1993 Cuts[†]	Cumulative Cuts Fiscal 1993-97	Fiscal 1993 Cuts[†]	Cumulative Cuts Fiscal 1993-97
California	543.6	75.0	38.3	123.9	58.8	170.7
Texas	190.3	31.8	20.8	49.9	25.6	66.4
New York	171.4	29.5	17.4	45.2	21.9	60.3
Virginia	147.2	23.3	18.6	40.2	22.5	52.8
Massachusetts	130.9	25.8	10.8	32.2	15.1	43.7
Ohio	123.3	19.4	13.0	32.3	16.2	43.2
Pennsylvania	115.2	15.1	12.2	30.3	15.4	40.1
Florida	112.0	18.1	10.7	28.4	13.9	38.0
Connecticut	90.0	19.8	10.8	25.7	12.5	33.8
New Jersey	88.1	13.3	9.4	23.1	11.9	30.8
U.S. total	2,924.7	440.3	278.9	730.8	362.7	983.2

Notes: Figures do not include Department of Defense military or civilian employees. The effects of past cuts by state are authors' estimates and are based on three-year moving averages of prime contract awards. Other estimates are from Conrad Schmidt and Steven Kosiak, *Potential Impact of Defense Spending Reductions on the Defense Industrial Labor Force by State*, Defense Budget Project, March 1992.

[†]The largest labor force effects for all states, under both the Bush fiscal 1993 budget and the deep cut option, are projected to occur in fiscal 1993.

affected state under both the Bush fiscal 1993 budget and the deep cut options, losing 1.7 percent and 2.3 percent of total employment, respectively, between fiscal years 1993 and 1997.

Connecticut's defense manufacturing sector is concentrated in the shipbuilding and aerospace industries and is dominated by defense industry giants General Dynamics and United Technologies. General Dynamics' production of submarines at its Electric Boat Division in Groton has been hurt particularly badly by the build-down. The last Trident submarine produced by Electric Boat was funded in 1991, while those planned for 1992 and

Table 5

Industries with Largest Defense Output: 1990

Industry	Defense Output (Millions of 1982 Dollars)	Total Industry Output (Millions of 1982 Dollars)	Defense Share of Industry Output (Percent)
Radio, television and communications equipment	23,641.0	66,140.0	35.7
Aircraft[†]	11,659.1	26,360.6	44.2
Crude petroleum	8,389.3	93,571.6	9.0
Business services	16,062.4	499,037.8	3.2
Shipbuilding and repair	10,060.3	10,213.5	98.5
Guided missiles and space vehicles	9,487.3	10,533.6	90.1
Aircraft and missile parts and equipment	9,195.7	18,749.7	49.0
Ordnance and accessories	9,002.1	12,870.6	69.9
Electronic components and accessories	8,387.4	36,390.7	23.0
Aircraft and missile engines and engine parts	7,507.3	17,365.3	43.2
Total of above	113,391.9	791,233.4	14.3
U.S. total	239,212.1	6,906,847.5	3.5

Source: David Henry, *Industrial Output Effects of Planned Defense Spending: 1990-1994*, U.S. Department of Commerce, February 1991.
[†]Excludes engines and parts.

Table 6

Defense Industry Employment Declines:
States with Largest Cuts as a Percentage of Fiscal 1992 State Employment
Percent

State	Total Fiscal 1992 Defense Employment	Cumulative Cuts Fiscal 1988-92	Bush Fiscal 1993 Budget		Deep Cut Option	
			Fiscal 1993 Cuts	Cumulative Cuts Fiscal 1993-97	Fiscal 1993 Cuts	Cumulative Cuts Fiscal 1993-97
Connecticut	6.0	1.3	0.7	1.7	0.8	2.3
Virginia	5.3	0.8	0.7	1.4	0.8	1.9
Massachusetts	4.8	0.9	0.4	1.2	0.6	1.6
California	4.4	0.6	0.3	1.0	0.5	1.4
Maryland	4.1	0.7	0.5	1.1	0.6	1.4
Washington	3.5	0.4	0.2	0.8	0.4	1.1
Missouri	3.5	0.9	0.4	1.0	0.5	1.3
Colorado	3.3	0.5	0.2	0.7	0.3	1.0
Arizona	3.2	0.7	0.3	0.8	0.4	1.1
Alaska	3.1	0.3	0.2	0.6	0.3	0.8
U.S. total	2.7	0.4	0.3	0.7	0.3	0.9
Memo: New York	2.2	0.4	0.2	0.6	0.3	0.8
New Jersey	2.6	0.4	0.3	0.7	0.4	0.9

Sources: The effects of past cuts are Federal Reserve Bank of New York estimates. Other estimates are from Conrad Schmidt and Steven Kosiak, *Potential Impact of Defense Spending Reductions on the Defense Industrial Labor Force by State*, Defense Budget Project, March 1992.

Note: Total nonagricultural U.S. employment is as of September 1992, while total nonagricultural employment for states is as of July 1992.

1993 have been canceled. Moreover, future procurement of Electric Boat's Seawolf submarine has been cut dramatically. Finally, there is no significant possibility of converting Electric Boat's facilities to commercial production: the U.S. shipbuilding industry no longer has a civilian market for its products.

Several factors combine to make the transition for the hard-hit states relatively difficult. First, the effect of defense cuts on total state employment will be greater than the above figures suggest, because the figures exclude indirect impacts that depend on spending by defense industry employees. One way to illustrate the total impact of defense job losses on a state's economy is to draw a parallel with steel industry declines. The most severely affected states—Pennsylvania, Ohio, Michigan, Indiana, and Illinois—suffered cumulative steel industry job losses of 0.6 to 1.6 percent of state employment between 1979 and 1984. These declines are similar to the job losses forecast for defense-dependent states over the next few years. During the period of sharpest steel industry decline, unemployment in steel-dependent states exceeded the national rate by an average of 2 percentage points—though, of course, one cannot determine precisely how much of the difference reflects the direct and indirect effects of the steel industry decline.

Second, current economic weakness in a number of defense-dependent states—caused in part by past defense industry cutbacks—will make it more difficult for laid-off workers to find new jobs. Unemployment rates in the most heavily defense-dependent states have risen far more rapidly than the rates for the United States as a whole.[12] Finally, the occupational profile of defense industry jobs—well-paying manufacturing employment with an unusually high share of administrative support, professional, and technical workers—suggests that these positions will be particularly difficult for states to replace.[13]

The effect of the build-down on localities could be significantly more severe than the impact at the state level. Regions that rely heavily on defense and have few nondefense industries to provide alternative sources of employment are most vulnerable. Even where other jobs are available locally, they may be a poor match for the skills of former defense workers. Those defense workers who succeed in finding other local employment must often accept lower wages than they enjoyed in defense manufacturing. The Congressional Budget Office recently used the *hypothetical* closing of the Bath Iron Works in Maine to illustrate one possible worst-case scenario of defense cuts.[14] The 11,000 workers employed by Bath Iron Works, a major shipbuilder for the U.S. Navy, constitute roughly 5 percent of total employment in south coastal Maine. The Congressional Budget Office estimates that the combined direct and indirect impacts of the hypothetical closing of the facility would raise the rate of unemployment along Maine's south coast by as much as 7 percentage points. Moreover, prospects for the reemployment of former defense workers within the region are poor because few alternative sources of local employment use comparable skills or offer comparable pay.

In sum, the concentration of defense spending in a relatively small number of states and industries will make the microeconomic transition to lower defense spending more difficult. The build-down will most severely affect those states that depend heavily on defense, including Connecticut, Virginia, and Massachusetts. In absolute terms, however, California is expected to lose the greatest number of jobs. Similarly, the most defense-dependent industries—including shipbuilding, missiles, and ordnance—are likely to experience declines in both defense and total industry output.

Conclusion

Although the current defense build-down is large in absolute terms, it is considerably smaller as a percent of GDP and as a percent of total employment than the build-downs after the wars in Korea and Vietnam. That comparison, however, may understate the difficulty of the adjustment. The current build-down is heavily weighted toward procurement, resulting in absolute declines in private sector defense industry employment comparable to those that occurred during the Vietnam War build-down.

Because of its relatively modest proportions, the current build-down will yield a relatively small peace dividend. Therefore, the build-down by itself is likely to provide only a partial solution to our deficit problem, even if the cuts in defense spending are not offset elsewhere in the budget.

The available evidence suggests that, at the national level, the defense build-down to date has played a relatively minor role in the below-potential growth that the U.S. economy has experienced since 1989. How-

[12]A recent study by Olivier Blanchard and Lawrence Katz suggests that although the rise in unemployment associated with a negative shock such as the defense build-down will dissipate within five to seven years, employment growth will remain on a permanently lower path ("Regional Evolutions," *Brookings Papers on Economic Activity,* 1992:1, pp. 1-75).

[13]David Henry and Richard Oliver, "The Defense Buildup, 1977-1985: Effects on Production and Labor," *Monthly Labor Review,* August 1987, pp. 3-11.

[14]Congressional Budget Office, "The Economic Effects of Reduced Defense Spending," February 1992.

ever, the private defense industry tends to be concentrated geographically, with the result that some states are more adversely affected than others. The most severely affected states are those where the defense industry is a significant fraction of the economy, such as Connecticut, Virginia, and Massachusetts. But a number of other states, led by California, Texas, and New York, continue to experience large absolute declines in defense industry employment.

Treasury and Federal Reserve Foreign Exchange Operations

May-July 1992

The dollar came under strong downward pressure during the May-July period, declining over 10 percent against the German mark and most other European currencies, nearly 5 percent against the Japanese yen, and over 8 percent on a trade-weighted basis.[1] The dollar's decline was a product of weaker than expected data on U.S. growth and employment and related declines in both short- and long-term dollar interest rates, which contrasted with an upward tendency in European interest rates.

Expectations mounted during the period that the German authorities would engineer a further rise in short-term mark interest rates, thereby adding to the already impressive interest differential in favor of mark investments over their dollar counterparts. At the same time, the defeat of a referendum in Denmark to ratify that country's participation in European monetary and political union triggered large and occasionally destabilizing flows of funds out of the higher-yielding European currencies and into the mark. Although the impact of these flows was felt primarily within Europe, demand for marks reinforced the other pressures weighing on the dollar.

Meanwhile, market participants became convinced during the period that the Japanese authorities were

A report presented by William J. McDonough, Executive Vice President in charge of the Financial Markets Group and Manager of Foreign Operations for the System Open Market Account. Daniel H. Brotman was primarily responsible for preparation of the report.

[1]The dollar's movements on a trade-weighted basis are measured using an index developed by the staff of the Board of Governors of the Federal Reserve System.

eager to see a further appreciation of the yen. This belief, supported by numerous official statements from Japan, the United States, and Europe and by rumors of central bank intervention to support the yen, added periodically to the market's willingness to sell dollars.

With the dollar rapidly approaching historical lows, a July summit meeting of the leaders of the Group of Seven (G-7) nations heightened the market's focus on official policies toward exchange rates. The absence of any reference to exchange rates in the summit's concluding communiqué, coupled with what appeared to be ambiguous official statements during and following the meetings, led some market participants to conclude that the G-7 was unconcerned about the dollar. Shortly thereafter, the German authorities announced an increase in their discount rate. While the German discount rate increase did not lead to a significant rise in other mark interest rates, market participants saw the move as potentially opening the door to a further widening of interest rate differentials unfavorable to the dollar.

In this environment, market participants began to adopt large short-dollar positions on the premise that the dollar faced little risk of an appreciation but good prospects of a further decline. This perception of the dollar as a one-way bet, coupled with the absence of any source of strong support for the dollar in the marketplace, caused the currency's decline to accelerate. Concerned with developments in the market, the U.S. monetary authorities intervened on July 20 in concert with a number of foreign central banks, purchasing $170 million against the mark. The concerted operation calmed the market, and the dollar traded

quietly through the remainder of the period.

Dollar trends lower in May amid mixed views on U.S. economy

Sentiment toward the dollar during the month of May reflected the market's outlook on the U.S. economy—uncertain but hopeful. Earlier in the year, the dollar had risen sharply as market participants grew more confident about the strength and sustainability of the U.S. recovery. From lows of just above DM 1.50 against the mark and ¥122 against the yen in January, the dollar climbed to highs of around DM 1.68 against the mark and ¥135 against the yen in early spring. By April, however, doubts about the durability of the recovery began to reemerge. Indeed, market participants viewed a decline in the U.S. federal funds rate in April as a sign of renewed official concern over weaknesses in the U.S. economy, and the dollar opened the period at just below DM 1.68 and just above ¥133.

Data on U.S. economic activity in May continued to paint a mixed picture of the recovery. The April employment report, released on May 8, showed an unexpected pickup in payrolls and a slight drop in the unemployment rate to 7.2 percent from 7.3 percent in March. But other reports, including those on M2 money supply

Chart 1

The dollar came under strong downward pressure during the May-July period in response to weaker than expected data on U.S. growth and employment and associated declines in dollar interest rates.

Percentage change

Swiss franc
German mark
Canadian dollar
Japanese yen
British pound

1992

Notes: The chart shows the percentage change of weekly average rates for the dollar from December 31, 1991. All figures are calculated from New York closing rates.

growth, reinforced the view that growth would be sluggish at best. Meanwhile, press reports and market commentary suggested that the Federal Reserve had shifted its policy from a bias toward easing to a more neutral stance. With these developments proving insufficient to sustain all of the market's hopes for recovery, the dollar edged lower in relatively directionless markets. Having reached highs for the period of DM 1.6510 against the mark and ¥133.75 against the yen in early May, the dollar eased back to end the month around DM 1.60 and ¥128.

In May, the dollar traded more softly against the yen than it did against the mark. This divergence occurred against a backdrop of developments that appeared on balance to support the yen and weigh somewhat on the mark. With regard to the yen, official statements and rumors of central bank intervention were seen as indicating general support within the G-7 for Japan's stated preference for a strong yen. Market participants recalled that the G-7, at its April meeting, had stated that "the decline of the yen ... was not contributing to the adjustment process." Although the yen had appreciated somewhat since then, the market read signals from policy makers as evidence that the authorities sought, or would at least tolerate, further gains. For a time, this view provided underlying support for the Japanese currency.

The mark, in contrast, appeared to be falling out of favor among investors amid domestic political uncertainty and labor strife. Although many market participants were wary of the risk of further monetary tightening in Germany, the view that German policies were not having their desired impact weighed on the mark. Indeed, several countries in the European Monetary System (EMS) took advantage of the mark's relative weakness to ease monetary conditions in the hope of stimulating economic activity at home.

Danish vote on single European currency heightens demand for mark

Investor sentiment toward the mark shifted abruptly in early June with the defeat of a referendum in Denmark on the Maastricht treaty—a treaty outlining steps toward European union, including economic and monetary union and the creation of a single European currency. Market participants viewed the Danish rejection as a blow to the prospects for a single European currency in the foreseeable future. In their view, abandonment of the agreed timetable for monetary union would loosen the tight discipline that the Maastricht treaty had implied for European inflation rates and budget deficits and thus raise doubts about the likelihood of continued convergence of European fiscal and monetary policies. In this environment, funds that had been invested in
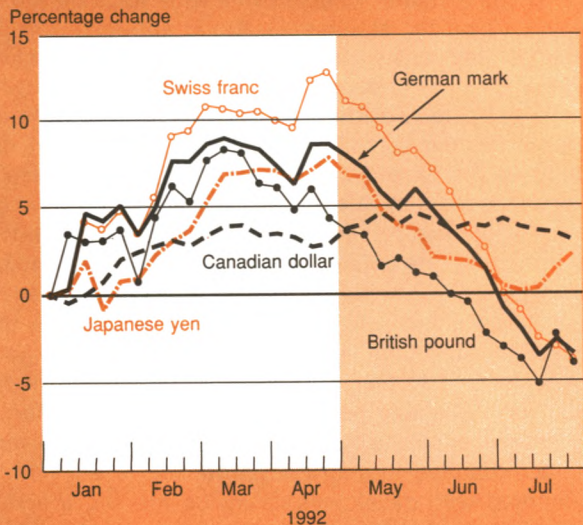
higher yielding European currencies such as the Italian lira, French franc, and Spanish peseta were suddenly pulled out and reinvested in the mark. As the mark rose sharply within the Exchange Rate Mechanism of the EMS, talk of an imminent EMS realignment reemerged.

At the same time, expectations regarding German monetary policy began to shift. The conclusion of wage negotiations in Germany in mid-May left market participants wondering what the implications of the wage settlements would be for German monetary policy and whether the Bundesbank would now begin to ease policy. While few observers expected an immediate decline in rates, many believed easier policy would be forthcoming before the end of the year. In late May and in June, however, a series of official statements out of Germany appeared to quash these hopes. Pointing to rapid money supply growth, high wage settlements, and persistently high inflation results, Bundesbank officials cautioned that German interest rates would remain high for the foreseeable future.

Dollar's decline against mark accelerates in June and July amid weaker outlook for U.S. economy
Meanwhile, expectations began to build that monetary policy in the United States would again be eased. Expectations of lower U.S. interest rates grew in tandem with mounting evidence that the U.S. recovery was not gaining strength. In early June, the Labor Department reported a smaller than expected gain in payroll

employment and a rise in the unemployment rate to 7.5 percent from 7.2 percent. Subsequent data on both inflation and real economic activity reinforced the view that the authorities had room to guide short-term rates lower. Notwithstanding these reports, market participants continued to believe that the Federal Reserve was reluctant to ease policy without conclusive evidence of renewed weakness in the U.S. economy.

On July 2, with the release of yet another month's figures for employment, the market became convinced that conclusive evidence of weakness was at hand. A report of an unexpected decline in payroll employment and large rise in the unemployment rate to 7.8 percent triggered a sharp decline in dollar exchange rates as dealers anticipated a policy response by the Federal Reserve. Within the hour, the Federal Reserve cut its discount rate ½ percentage point to 3 percent and relaxed reserve pressures to an extent consistent with about a ½ percentage point reduction in the federal funds rate. In response, dollar interest rates began to soften, and interest rate differentials between the dollar and most major foreign currencies moved further against the U.S. currency.

Uncertainty surrounding the U.S. presidential campaign reinforced, for a time, the market's negative sentiment toward the dollar. In June and early July, foreign investors expressed confusion and concern over the potential implications of a three-way presidential race. The possibility that elections in November would not

Chart 2

By July, the dollar was trading within five percent of its historical lows against the German mark and Japanese yen.

German marks per U.S. dollar

Japanese yen per U.S. dollar
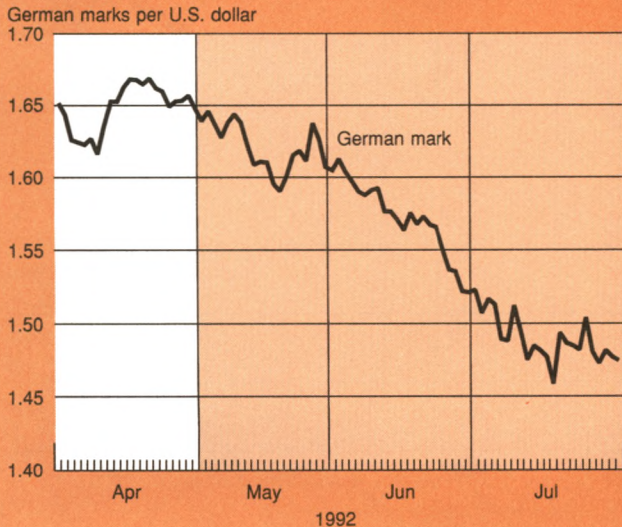
result in a clear victory for any candidate was enough, when combined with other factors weighing on the dollar, to discourage inflows into U.S. stock and bond markets.

**Concerns over fragility of Japanese economy and stock market weigh on yen**
As the dollar began declining more rapidly against the mark and other European currencies, its decline against

Chart 3
Short-term interest rates declined in the United States and Japan.
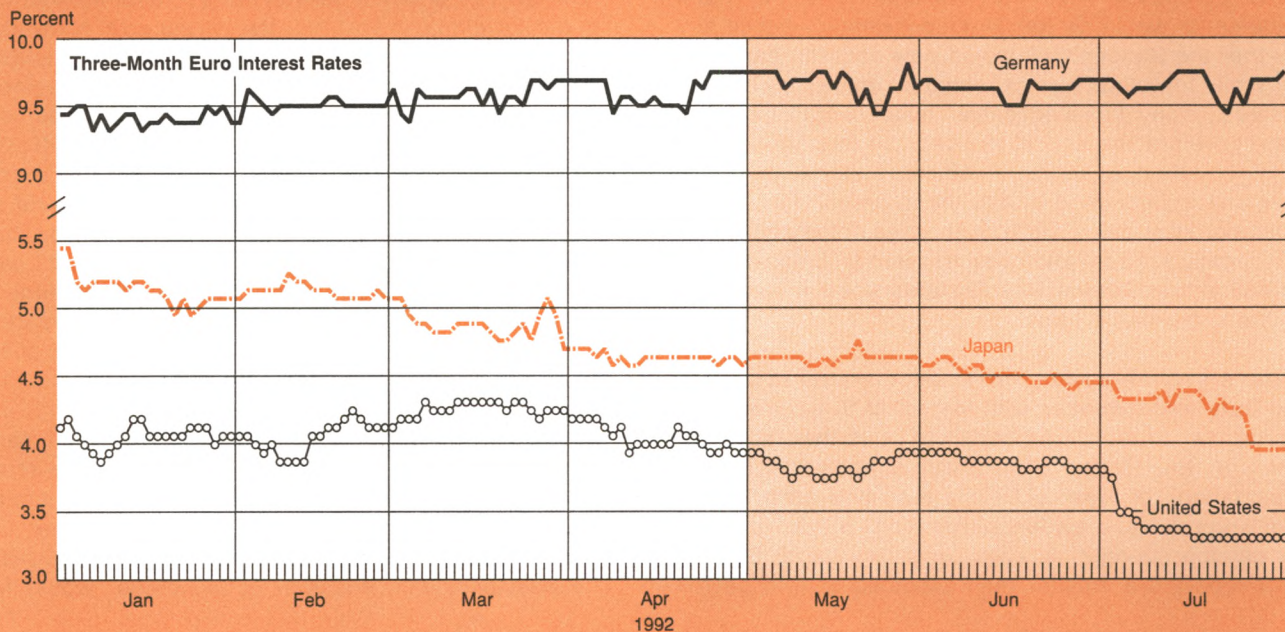
As a result, the interest rate differentials unfavorable to the dollar widened against the German mark while holding steady against the Japanese yen.
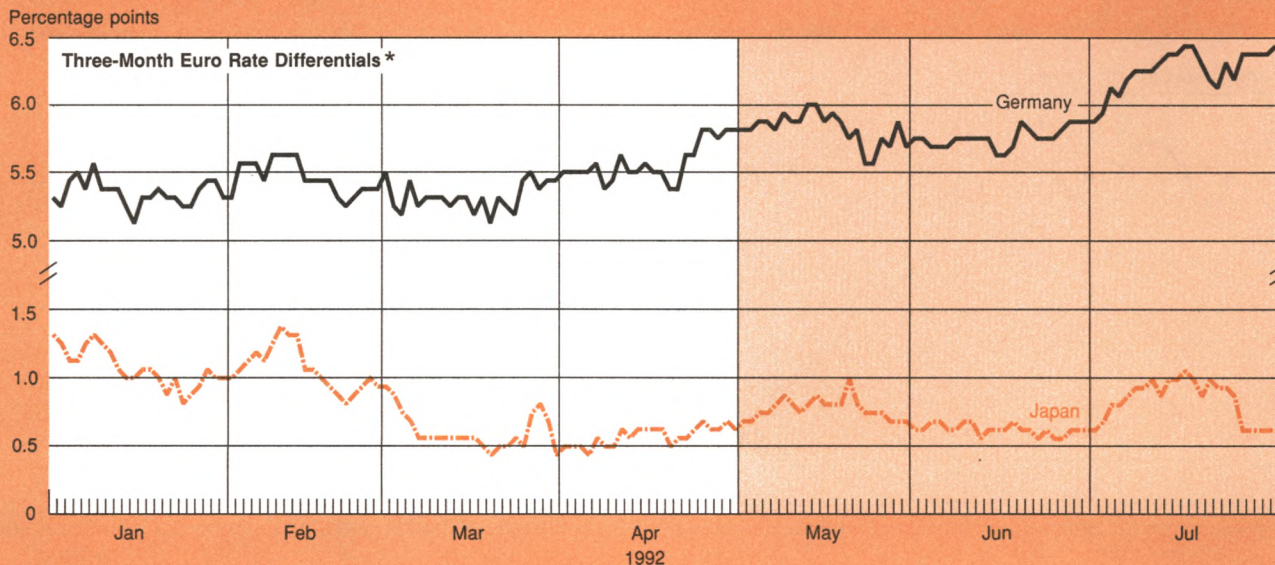
* Foreign rate minus U.S. rate.

the yen moderated somewhat. The dollar's relative resilience against the yen occurred as Japanese interest rates softened in response to evidence of increasing weakness in the Japanese economy and worries over the fragility of the Japanese equity market. In mid-June, release of the Japanese central bank's quarterly survey of business conditions reinforced these concerns. The report, long regarded as an important indicator of future growth, showed an unexpectedly large decline in business sentiment. While the Japanese authorities described the report as reflecting the economy's downward adjustment at its most severe point, the Japanese stock market responded by tumbling to a new five-and-a-half-year low, and short-term Japanese interest rates declined as market participants anticipated easier Japanese monetary policy.

G-7 summit sharpens focus on official policy toward exchange rates

By early July, the dollar was trading below its level at the beginning of the year and within 5 percent of its historical lows against the major currencies. Official comments on exchange rates, when they occurred, appeared to express satisfaction with the movement in exchange rates. Against this background, the July 7-8 meeting of G-7 heads of state took on added importance in the market's view as participants sought clarification of the authorities' attitude toward the dollar.

The prevailing view in the weeks leading up to the meeting was that the authorities would call for a further appreciation of the yen to help resolve global trade imbalances. But with the dollar near all-time lows, some believed that the resulting communiqué might in fact contain language supportive of the dollar. In the event, the communiqué contained no direct reference to exchange rates. Comments by individual officials after the meeting, including a statement by Secretary Brady that the United States "is not seeking to depreciate the dollar," did not entirely dispel the overall impression that the G-7 authorities were unconcerned with the decline in the dollar. In this environment, the dollar began to decline sharply.

Within days of the G-7 summit, market attention shifted to a meeting of the Bundesbank Council in Frankfurt on July 16. Expectations that the German authorities would announce a tightening of monetary policy escalated in the days leading up to the meeting. But the announcement of a ¾ percentage point increase in the German discount rate—and subsequent increases in official rates in Italy, the Netherlands, Austria, Belgium, and Spain—nonetheless jolted the markets. Although the discount rate hike did not spur significant gains in money market rates and the Bundesbank denied that a Lombard rate increase would necessarily follow, market participants believed that the move paved the way for a subsequent rise in short-term mark rates. As a result, downward pressure built against the dollar and against the currencies of some EMS members.

In these circumstances, the U.S. monetary authorities intervened on July 20 in concert with a number of foreign central banks to support the U.S. currency. In several rounds of dollar buying, the Foreign Desk of the Federal Reserve Bank of New York purchased $170 million against marks. The intervention was fi-

Table 1

Federal Reserve
Reciprocal Currency Agreements
In Millions of Dollars

Institution	Amount of Facility July 31, 1992
Austrian National Bank	250
National Bank of Belgium	1,000
Bank of Canada	2,000
National Bank of Denmark	250
Bank of England	3,000
Bank of France	2,000
Deutsche Bundesbank	6,000
Bank of Italy	3,000
Bank of Japan	5,000
Bank of Mexico	700
Netherlands Bank	500
Bank of Norway	250
Bank of Sweden	300
Swiss National Bank	4,000
Bank for International Settlements:	
Dollars against Swiss francs	600
Dollars against other	
authorized European currencies	1,250
Total	30,100

Table 2

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

	Federal Reserve	U.S. Treasury Exchange Stabilization Fund
Valuation profits and losses on outstanding assets and liabilities as of April 30, 1992	+2,653.1	+1,039.5
Realized April 30–July 31, 1992	+336.2	+114.4
Valuation profits and losses on outstanding assets and liabilities as of July 31, 1992	+4,536.7	+2,503.9

Note: Data are on a value–date basis.

nanced equally by the Federal Reserve and the U.S. Treasury. Market participants responded strongly to the evidence of close cooperation among U.S. and foreign monetary authorities, and the dollar rose from its period low of DM 1.4470 against the mark in the morning of July 20 to over DM 1.48 later that day and to DM 1.50 by the end of that week. Pressures within the Exchange Rate Mechanism of the EMS also eased somewhat following the concerted central bank initiative.

The dollar held steady against the mark during the remainder of the period and rose slightly against the yen. Statements by German officials that the discount rate hike was not the first step of a broader tightening of monetary policy, and evidence that the German authorities were operating in their domestic markets to resist a rise in short-term mark interest rates, gradually dampened the market's expectation of higher German interest rates. Meanwhile, continued sharp declines in Japanese stock prices fueled expectations of monetary easing in Japan, and these expectations were realized on July 27 with the announcement of a ½ percentage point cut in the Japanese discount rate. In this environment of steady to lower interest rates abroad, pressures on the dollar subsided. The dollar closed the three-month reporting period at DM 1.4745 against the mark and ¥127.10 against the yen.

* * * *

In other operations during the period, the U.S. monetary authorities purchased a total of $6,176.6 million against marks in a series of off-market spot and forward transactions with the Bundesbank. The arrangement with the Bundesbank was similar to a transaction conducted last year. It followed an agreement between the U.S. and German authorities that their respective holdings of German marks and dollars were in excess of current needs and that it was to their mutual advantage to reduce those holdings. Sixty percent of the marks were sold for the account of the Federal Reserve, with the remainder sold for the account of the U.S. Treasury. A spot transaction of $2,503.9 million settled on May 22 and a forward transaction of $743.7 million settled on July 21. The remaining forward transactions are to be settled later in the 1992 calendar year.

During the May-July period, the Federal Reserve realized profits of $336.2 million, of which $316.5 million resulted from settlement of portions of the aforementioned off-market currency transaction. The U.S. Treasury realized profits of $114.4 million, including $101.2 million resulting from settlements under that transaction. Cumulative bookkeeping or valuation gains on outstanding foreign currency balances at the end of July were $4,536.7 million for the Federal Reserve and $2,503.9 million for the Exchange Stabilization Fund (ESF). These valuation gains represent the increase in the 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.

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 are invested in securities issued by foreign governments. As of the end of July, holdings of such securities by the Federal Reserve amounted to the equivalent of $9,315.9 million, and holdings by the Treasury amounted to the equivalent of $9,213.6 million, both valued at end-of-period exchange rates.

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Library of Congress Card Number: 77-646559