Economic Review

FEDERAL RESERVE BANK OF KANSAS CITY

May 1986

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In the United States

Corporate Mergers
And the Business Cycle

Market Perceptions
Of U.S. Monetary Policy Since 1982

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Economic Review

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The Rapid Growth of Debt In the United States 3

By Paul A. Volcker

The debt of the U.S. economy's domestic nonfinancial sectors has increased rapidly in recent years. Concerns over this rapid growth need to be addressed with a more balanced approach to economic policy along with a regulatory structure that will ensure a sound financial system.

Corporate Mergers And the Business Cycle 13

By Sean Becketti

Much of the recent increase in corporate mergers appears to have been due to general economic conditions. Real interest rates seem to have had the greatest influence because of the use of debt financing of acquisitions.

Market Perceptions Of U.S. Monetary Policy Since 1982 27

By V. Vance Roley

Interest rate behavior since 1982 has been consistent with a Federal Reserve operating procedure different from both the procedure used in the 1970s and that used in the 1979-82 period.

The Rapid Growth of Debt In the United States

By Paul A. Volcker

I appreciate this opportunity to discuss the rapid growth of debt in the United States and its possible implications for our financial markets and economy. As you know, this is a subject about which I have expressed some concern from time to time over the past few years, and I welcome an exploration of the many difficult and complex issues it raises. Given those difficulties and complexities, no single hearing can do more than identify tendencies, raise questions, and point to areas for further study. In that sense, this testimony is more descriptive than prescriptive, but I think it does suggest the importance of the subject.

The increase in indebtedness since the early 1980s certainly has been extraordinary. The debt of domestic nonfinancial sectors—the measure of credit monitored by the Federal Open Market Committee—has increased at rates ranging from around 11 to 14 percent in each of the three years of the current economic expansion. This growth has been much faster than the nominal increase in GNP and income, breaking a pattern that had persisted through most of the postwar period.

Until the early 1980s, debt and income expanded at roughly comparable rates over time, and the ratio of debt to income fluctuated at or just below 140 percent. Since then, however, as debt expansion far outpaced the growth of income, this ratio has risen sharply to almost 170 percent at the end of 1985. Historically, changes of that magnitude, up or down, are unusual except in highly disturbed economic circumstances—depressions, wars, or major inflations—not just in the United States but also, so far as comparable statistics are readily available, in other major countries. That itself raises questions as to what is different now.

In that connection, I should emphasize that there is nothing particularly significant or alarming, in itself, about one or another ratio of debt to income. Even if the statistics were

Paul A. Volcker is Chairman of the Board of Governors of the Federal Reserve System. This article is based on a statement before the Subcommittee on Telecommunications, Consumer Protection and Finance of the Committee on Energy and Commerce of the House of Representatives on April 23, 1986.

fully comparable and accurate through time, there are a number of reasons why the ratios might change over time or between countries. One major influence, for instance, is the amount of financial intermediation characteristic of an economy. The data I just cited net out debt of defined financial intermediaries—banks, thrifts, finance companies, and other "financial" firms. But "nonfinancial" firms and governments both lend and borrow, more today than before, and, from one point of view, the related debt is double counted in the data. Stated another way, offsetting borrowings and loans on balance sheets of firms may not suggest the same risks and "leveraging" as borrowings not matched by comparable financial assets.

However, even after allowing for identified areas of double counting or greater intermediation—for instance, the spate of advance refundings late last year by state and local governments—the overall data do strongly suggest greater leveraging among borrowers; that is, a larger burden of interest and principal payments relative to net worth and income streams. In the corporate sector, the same conclusion is implicit in the massive net retirement of equity recently, amounting to some $150 billion over the last two years, even though retained earnings have been rising.

The increase in indebtedness since the early 1980s certainly has been extraordinary.

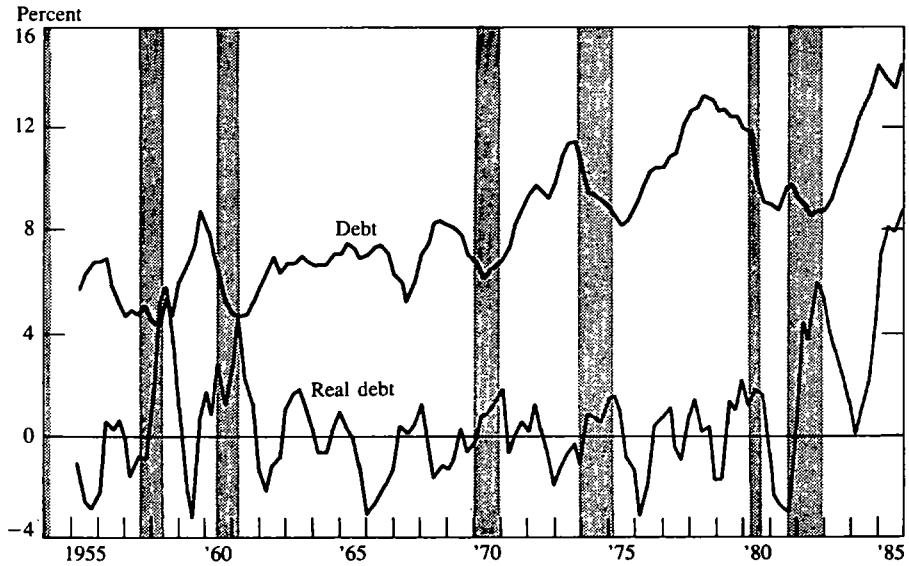
The willingness to take on large volumes of additional debt certainly has not impeded the economic expansion. To some degree, the high levels of borrowing have helped support the spending needed to keep the economy growing. However, at some point a rising debt load is not sustainable. Debt cannot rise without limit relative to income needed to service it, and increased leveraging implies smaller safety margins to deal with economic adversity. Consequently, continuing rapid growth of debt has disturbing implications for the fragility of the financial system over time, and the question is especially apropos at a time when certain important groups of borrowers are already under severe financial stress. The vulnerability of the economy to unanticipated increases in interest rates or a shortfall in income appears to be increasing, rather than the reverse. Surely we must be concerned about achieving a better balance in the sources of our economic expansion if we wish it to be sustained.

Sources of credit growth

The very structure of the growth of debt in the last few years reflects underlying imbalances in our national economy. To a considerable extent, the unusually rapid growth of debt in recent years directly reflects the borrowing by the federal government to finance an unprecedented string of budget deficits. Usually, budget deficits and federal borrowing decline as the economy recovers from recession, boosting tax receipts. In the last three years, by contrast, the budget deficit has remained extraordinarily high during the expansion, and federal debt held by the public has grown by more than 15 percent each year.

The federal government is our strongest borrower, and an increase in the federal debt ordinarily would not connote greater weakness in our credit structure. Even then, however, the need to service that debt requires higher taxation than would otherwise be necessary—with consequences for economic efficiency—and pressures of government debt service have historically sometimes led to excess money creation and inflation.

Growth of domestic nonfinancial debt, nominal and real
(Four quarter growth rates)



Note: Shaded areas indicate periods of recession.

Viewed from an economywide perspective, large borrowings by the federal government have typically been accompanied by small increases in private debt. In the current setting, however, borrowing by nonfederal sectors also has been unusually strong, with household, business, and state and local government indebtedness all rising relative to GNP.

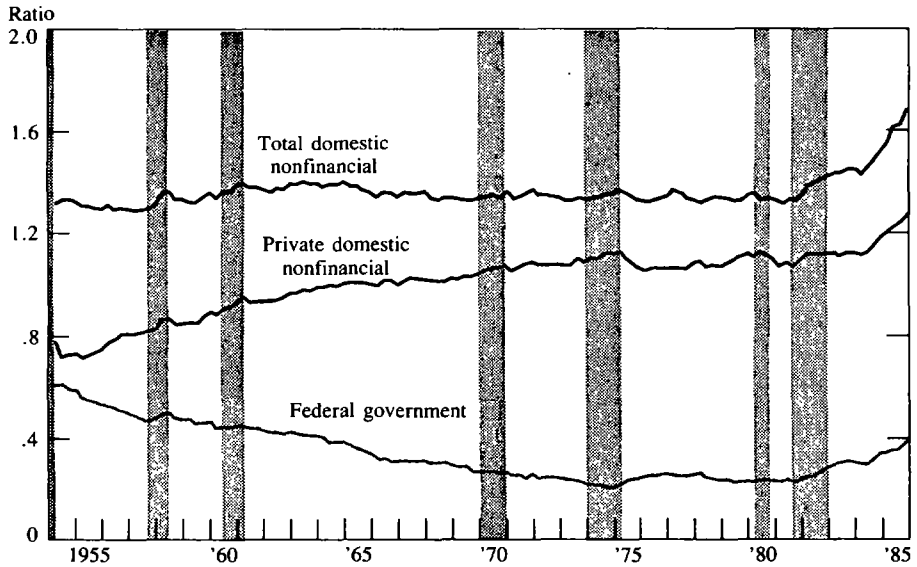
In that sense, it is hard to see direct evidence of "crowding out" of private borrowing. In substantial part, the simultaneous rapid expansion of both federal and private debt has been a reflection of the relative ease with which this country has attracted savings and capital from other countries in recent years.

In effect, there has been a massive imbalance between the generation of loanable funds at home and the amount of borrowings. The resulting pressures on interest rates have been moderated by the capital inflow from abroad. But that inflow exacts a price. The net transfer of financial resources has been accompanied by a similar transfer of real resources to the United States—or to put it in more comprehensible language, record trade deficits. And we have, in the space of a few years, reversed our position as the largest world creditor (net) and are in the process of becoming the largest world debtor.

We do not want those developments to continue indefinitely—ultimately they are both politically and economically unsustainable. The willingness of foreigners to advance credit to the United States is not inexhaustible, and the capital inflow and related trade deficit have been maintained at the expense of our own manufacturing industry.

Moreover, for a country as well as an individual or business, rising debt levels imply greater obligations to make interest payments out of future income. This would be less of a

Domestic nonfinancial debt
(Relative to nominal GNP)



Note: Shaded areas indicate periods of recession.

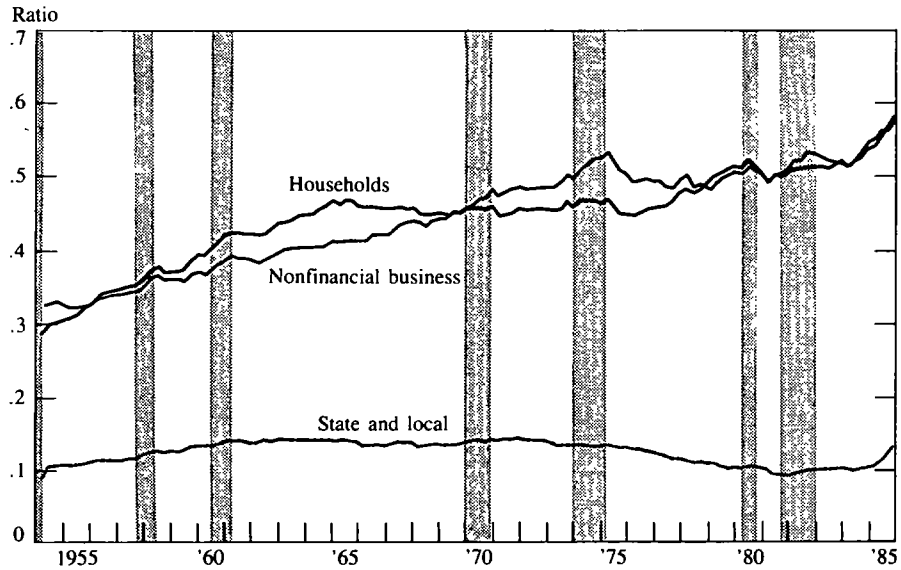
concern if the foreign savings could be seen as being used to build up our domestic productive capacity, improving our prospects for growth and giving us a stronger base from which to make interest or dividend payments abroad. But with domestic investment spending relatively modest in recent quarters, it seems evident that in large measure the foreign lending is going, directly or indirectly, to fill the deficiency in domestic saving created by federal deficits. In a real sense, the rapid growth of federal debt and imbalance in foreign transactions have placed a mortgage on our future.

Perhaps the most striking evidence of greater willingness to incur debt can be found in the substitution of debt for equity associated with the wave of mergers, leveraged buyouts, and stock repurchase programs over the last few years. These activities resulted in the gross retirement of around $100 billion in outstanding equity of nonfinancial corporations in 1984 and again in 1985, funded in the initial stages primarily by new debt issues, amounts not nearly offset by new sales of equity.

The unusual volume of equity retirements may have accounted for roughly one percentage point of debt growth each of the last two years. While some of this debt may subsequently be paid down through sales of assets, or with equity obtained by sales of stock or internally generated cash flow, it seems clear that at least for some time a significant number of businesses will be carrying more debt, and therefore greater financial exposure, than if these corporate restructurings had not occurred.

These concerns are mitigated by the substantial profits and cash flow of many businesses, so that equity and cash cushions have been better maintained than debt data alone might suggest. Moreover, the recent surge in

Private domestic nonfinancial debt by sector
(Relative to nominal GNP)



Note: Shaded areas indicate periods of recession.

stock prices has greatly bolstered the market value of corporate equity—ratios of market valuations of corporate debt to equity have actually declined in the past year. Declining interest rates also moderate the debt burden. Nonetheless, the trend in debt creation, if extended, would imply some increase in financial risk for the economic system.

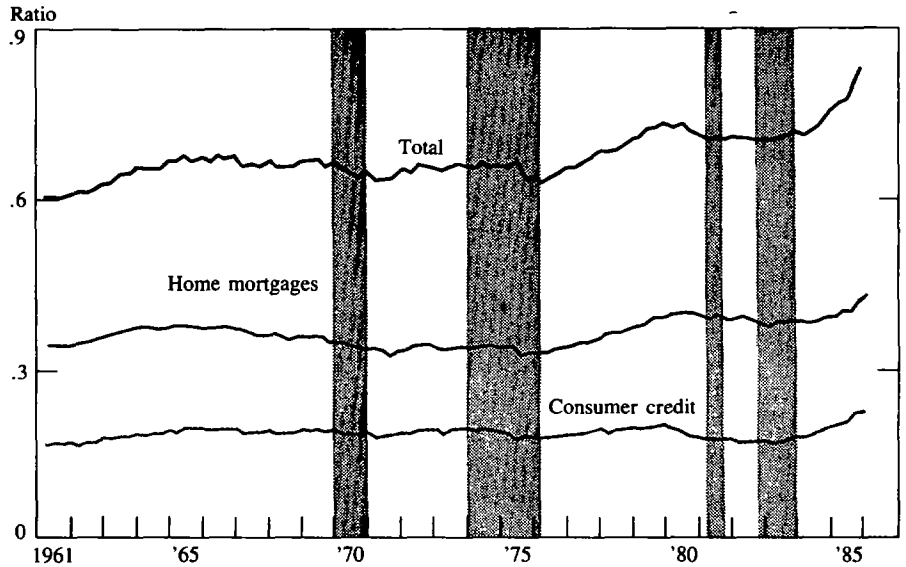
In the household sector, savings rates have been unusually low and both consumer and mortgage indebtedness has risen much more rapidly than disposable income. Some part of the rise in the ratio of debt to income for households—which stands at a postwar high—undoubtedly reflects lengthening debt maturities, shifting demographics, and greater convenience use of credit, rather than an underlying increase in debt burdens. Even so, it appears that households, like businesses, have become more willing to take on debt, at the expense of more vulnerable financial positions.

Shifting attitudes toward debt

The reasons for the apparent shift in attitudes are not easily identified and quantifiable. It is evident that the tax system favors debt over equity sources of funds for businesses through its differential treatment of interest and dividend payments. It also encourages household borrowing by allowing unlimited deductions for interest expenses. However, these provisions and their incentives have not substantially changed in the 1980s, and lower marginal tax rates tend to reduce the incentives.

The inflation experience of the 1970s probably had a profound effect on attitudes toward debt. During much of that period, inflation rates outstripped interest rates, making leveraged buying a seemingly attractive economic strategy. Some borrowers may have expected inflation to pick up again as the

Household debt and principal components
(Relative to disposable personal income)



Note: Shaded areas indicate periods of recession.

economy expanded after 1982, inducing them to buy in advance of price increases and in anticipation of repaying debts in dollars of lower real value. Perhaps they looked to some degree to the borrowing patterns of the federal government as justification of a view that debt creation is benign.

This tactic might have seemed quite risky and unattractive if borrowing had to be done at the high long-term rates prevailing over this period. But the greater availability of short-term and floating-rate instruments reduced the risk considerably, since if inflation did not rebound, short-term rates would be expected to move lower.

The shift to floating-rate instruments is but one example of innovations in financial markets that have played a role in supporting, if not encouraging, the growth of debt. The proliferation of techniques such as interest rate swaps, securitization of loan portfolios, and third-party guarantees may have given borrowers access to sources of funds that might otherwise have been closed to them, and reduced perceptions of risk. Many smaller or growing companies have long used low or unrated bonds as an important financing technique, and those securities clearly have a legitimate role in finance. But recent innovations, relying on the use of such bonds to finance large takeovers of well established companies, seem to have opened new channels from lenders to borrowers, increasing the flow of credit for particular uses.

For intermediaries, the rapid development of secondary markets at home and abroad for loans of various types has enabled them to originate a far larger volume of credit than would be consistent with their own command over resources. In addition, concerns over exposure to interest rate fluctuations probably do not constrain asset growth at banks or

thrifts to the degree they once did, given the greater opportunities to structure both assets and liabilities to manage the degree of interest rate risk.

At the same time, elimination of most deposit rate ceilings allows depository institutions to compete for funds for lending under a variety of circumstances, even if interest rates were to rise sharply. And the lifting of many usury ceilings has meant that lenders would continue to be willing to make credit available under such conditions. Thus, deregulation has substantially diminished the threat of constraints on credit availability as credit markets tighten, though it may also imply a wider swing in interest rates over the cycle.

From one perspective, these developments have increased the efficiency of our credit markets and improved the distribution of savings among competing uses. The greater variety of instruments available enables borrowers to tailor the maturity and other characteristics of debt to their specific needs or expectations. And with deregulation, borrowers probably feel a greater sense of assurance that funds will be available to roll over existing debt, even if interest rates should rise. On the supply side of the credit market, the ability of intermediaries to reduce interest rate risk, to compete for funds without regulatory constraint, and to replenish lendable funds through sales of assets probably has encouraged a more aggressive pursuit of lending opportunities and an eager embrace of innovative techniques to appeal to borrowers.

Consequences and concerns

On balance, the net effect of shifting attitudes and financial innovation appears to have been to increase the expansion of private debt. Many of the particular techniques developed are designed to reduce risks for one or more of the parties directly involved. The larger question remains as to whether risks have, in fact, been reduced on balance for the financial system and the economy as a whole. The increase in total debt burdens, the longer and larger chain of transactions between ultimate borrowers and lenders with a diffusion and possible widening of credit judgment, the greater internationalization of the system all raise questions.

On balance, the net effect of shifting attitudes and financial innovation appears to have been to increase the expansion of private debt.

One thing seems reasonably clear. More of the risk of unexpected movements in interest rates has been shifted onto borrowers. Most recently, borrowers have benefited from this shift, as declining interest rates have reduced their interest costs and enabled them to extend debt maturities at considerably lower rates than if they had been using long-term credit all along. But the strategy can, and does, carry considerable risk that an unanticipated rise in interest rates could sap the financial strength and creditworthiness of a substantial number of borrowers.

My general concern relates primarily to the degree to which the continuing buildup of debt may, as a byproduct of eroding financial positions, leave a substantial number of borrowers so extended that they would have great difficulty dealing with unanticipated financial setbacks. Of course, borrowers ordinarily do not take on debt they expect, with any high degree of probability, will cause them problems ahead (although even that assumption may not be valid with respect to a relatively few depository institutions in hard-pressed financial circumstances that have been willing, in effect, to make high-stake gambles with insured

depositors' money). Nonetheless, the larger the share of income devoted to debt servicing in relatively prosperous times or the smaller the equity cushion—and that has been the trend over rather a long period of time—the more likely it is that an unexpected shortfall in income or rise in interest rates will lead to problems in meeting obligations.

For individual borrowers, income could weaken owing to factors beyond their control, reflecting conditions in a particular region or industry as well as a general downturn in the economy. A substantial rise in interest rates could prove especially troublesome, given the still heavy reliance on short-term or floating-rate debt. Many borrowers may minimize such possibilities—and economic policy typically works to limit the risk. But all of history suggests it would be shortsighted to behave as if such possibilities did not exist.

The agricultural sector of our economy provides ample evidence of the effect of unexpected developments on highly leveraged borrowers. Those farmers who went deeply into debt in the late 1970s in anticipation of maintenance of higher land and crop prices are experiencing the most agonizing difficulties as these expectations are not fulfilled. Their problems in turn have severely weakened a number of agricultural lenders.

Potential vulnerabilities are suggested not only by elevated debt-to-income ratios throughout the economy, but also by the deterioration or disappointing performance of certain more direct indicators of financial distress at a time of rising economic activity generally. Corporate bond downgradings, for example, have trended sharply higher over the past two years, reflecting in part concerns about the effects of additional leveraging on the financial strength of certain corporations. In addition, problems in the household sector are indicated by some upward tendency in delinquency rates on consumer and mortgage loans or other measures of financial distress during the expansion period.

In another vein, I addressed earlier some of the implications of our growing dependence on capital and credit from abroad. That is hardly a dependable source of financing for years to come and indeed will shrink as our trade balance improves, as we hope.

I do not suggest that these developments point to some inexorable accumulation of debilitating financial difficulty. Indeed, there are a number of developments currently working in the opposite direction. Recent substantial declines in interest rates and increases in stock prices have helped to alleviate pressures on financial positions. The fall in rates by itself will reduce debt-servicing burdens, and both firms and households have taken advantage of the considerable downward movement in long-term rates to lengthen the maturities of their liabilities, locking in lower rates and reducing exposure to an unanticipated rise in short-term rates. The higher stock prices are currently strengthening the financial positions of many individuals and companies. New stock issues have picked up. And recent regulatory and supervisory initiatives can help.

At the same time, enough has gone on, and continues to go on, to raise clear warning signals, to justify further analytic effort, and to support action in areas where such action is plainly warranted.

Addressing the concerns

We know enough to understand that disproportionate increases in debt extended over the years do not constitute a solid, sustainable base for satisfactory economic growth and stability indefinitely into the future. Ultimately, debt can only be serviced from income. If that relationship is strained, financial pressures

will jeopardize further growth in income itself, aggravating the difficulties. The time to act is before the strains become oppressive, not after.

The most direct step that can be taken by the government itself to address concerns about the growth of debt is to decrease, and eventually eliminate, the federal budget deficit. Such a course will reduce pressures on domestic credit markets, freeing domestic savings to be channeled into domestic investment and encouraging further restructuring of balance sheets through greater reliance on long-term debt and equity. By promoting better balance between spending and income domestically, it will also work to reduce dependence on foreign capital.

Some of these effects already were discernible as the Gramm-Rudman-Hollings legislation moved toward passage late last year; the improved outlook for budget balance appeared to contribute materially to the decline in rates on bonds and fixed-rate mortgages, in an environment in which the dollar was also depreciating toward levels more consistent with restoring the international competitive position of U.S. products. Concrete actions to implement the law will provide a constructive background for financial markets over coming years, partly by its direct effects and partly by reducing the chances of a resurgence in inflationary pressures.

Beyond that step, I believe the time has come for Congress to also address those elements of our tax code that so strongly favor debt finance. While that "bias" has long existed, other changes in the economic and financial environment seem to have had the effect of making it more important in decision making.

The original Treasury tax reform proposal had some limited elements that moved in the right direction; they have subsequently been dropped or sharply diluted. One lesson, I suppose, is that no strong constituency has emerged for a reform with such diffuse and seemingly indirect benefits. But I also believe that other efforts to reduce excessive reliance on debt in the private sector pale into relative insignificance so long as that basic bias imbedded in the tax system exists.

I noted that deregulation and innovation may encourage growth of debt. Those changes respond to basic technological and competitive forces that cannot be denied. We can, however, respond in constructive ways, strengthening, when neccessary, oversight of key markets and intermediaries so that they do not become the unwitting vehicles for the spread of problems through the economy.

Ultimately, debt can only be serviced from income.

To this end, the Federal Reserve, working in concert with other regulators of depository institutions, has stepped up its examination of banks and bank holding companies, tightened capital standards, and proposed keying those standards to the risk profile of the banks. We and the other bank regulators are also acting to deal with present points of strain, particularly in the agricultural and energy areas, through a variety of techniques. We have also joined with the other regulators in requesting that Congress extend and liberalize legislative authorization for interstate acquisition of troubled institutions.

These are essentially defensive measures designed to keep immediate problems from infecting the financial system more generally by easing adjustments in individual institutions and local areas. These measures are not, and cannot be, a substitute for forward-looking structural change.

In that connection, it seems to me impera-

tive to clarify and modernize the laws governing the structure of our depository and financial systems. Too often in recent years, old legislation has clashed with new market facts. Accommodation is achieved more by the exploitation of perceived loopholes in existing law than by a well-considered design of how we want the financial system to evolve. Distinctions among banking, other financial institutions, and commercial firms are fast eroding and there is little considered debate—and less action—to guide the process.

For a long time, as the result of the lessons of past financial crises, the unique role of banking and the payments system in our economy has, in concept, been recognized through provision of a federal "safety net," backed up by special oversight and supervision. Today, the distinctions underlying that approach are rapidly eroding, raising new questions about our ability to maintain the stability of the whole. The situation cries out for review and for new laws, adapted to the problems of today and tomorrow.

Nor can we evade a review of the basic safeguards and trading practices in other key sectors of financial markets, given the complex interdependencies that exist. One specific example came to your attention last year, and the Committee responded by providing a legislative framework for limited surveillance and regulation of the government securities market. As you know, action has not yet been completed on that matter.

Conclusion

In one sense, the extraordinary volume of credit flows in recent years is a tribute to the efficiency and innovative instincts of financial intermediaries, borrowers, and lenders alike. There has been rapid and effective response to new technological possibilities.

Those same developments also highlight the complex interactions involved and the new interdependencies created. And, in the end, credit creation is constructive only to the extent that the obligations are manageable in relation to income.

It is in those areas that questions arise.

I must emphasize that the government can take a number of basic steps to address concerns about the rapid growth of debt. These include, most importantly, a balanced approach to economic policy, including cutting excessive budget deficits and a fresh look at some important provisions of the tax code. Government must also provide a supervisory and regulatory structure to promote a sound financial system.

Ultimately, and quite properly in our free market economy, the strength of our financial system must also ultimately rest on the prudent decisions of private parties. Borrowers and lenders must recognize risks and act to manage them. In such a context, the growth of debt would hold no concerns for us, but rather would be seen as an integral part of a healthy and active economy.

Corporate Mergers And the Business Cycle

By Sean Becketti

Corporate mergers have increased markedly in recent years. The number of mergers nearly doubled over the last five years, increasing from 1,526 acquisitions in 1979 to 2,999 in 1984. The real dollar value of mergers nearly tripled, increasing from $85.1 billion (1982 dollars) in 1979 to $242.1 billion in 1984.[1] In 1984 alone, there were 14 mergers with market values of more than a billion dollars each. One merger, Chevron's acquisition of Gulf in 1984, had a price tag of $13.3 billion, nearly twice the value of any previous merger.

The recent period of merger increase is not unique, however. There have been at least three previous waves of mergers in modern U.S. industrial history: the creation of large trusts in the 1890s, the formation of oligopolies in the late 1920s, and the rash of conglomerate mergers in the 1960s. The apparently periodic nature of merger waves has led to two approaches to the study of merger activity. Some economists view merger waves as unique episodes that can be attributed to particular changes in the law or in government regulations. According to this view, events such as the Department of Justice's relaxation of antitrust enforcement in 1982 and 1984 help explain the recent merger boom.[2]

Other economists focus on the procyclical nature of merger activity, the tendency for mergers to increase rapidly as the economy expands and to slow as the economy contracts. According to this view, fluctuations in such macroeconomic variables as interest rates and stock prices may help explain fluctuations in

[1] These figures are from the database compiled by *Mergers and Acquisitions* magazine.

Sean Becketti is an assistant professor at the University of California at Los Angeles and a visiting scholar at the Federal Reserve Bank of Kansas City. Michael Grace and Thomas Dean, research associates at the bank, assisted in the preparation of the article. The views expressed in this article are those of the author and do not necessarily reflect the views of the Federal Reserve Bank of Kansas City or the Federal Reserve System.

[2] This argument is advanced in the *Economic Report of the President*, Council of Economic Advisers, U.S. Government Printing Office, 1985, Chapter 6.

merger activity.[3] More recently, there has been increased interest in the possible effect of merger activity on the macroeconomy. Concerns have been raised about the possibly detrimental effects of merger activity on credit markets and the behavior of the monetary aggregates.[4]

This article examines the relationship between corporate merger activity and the business cycle. The analysis focuses on two issues. First, to what extent can merger activity be explained by such macroeconomic variables as interest rates, output, and stock prices? Second, do mergers appear to have systematic effects on real and financial variables? Specifically, do mergers have detrimental effects on the macroeconomy?

The next section examines the nature of mergers, discusses how mergers are financed, and places the current merger wave in historical perspective. The second section reviews some hypotheses about potential relationships between mergers and the business cycle. The third section tests these hypotheses by using data for the last 25 years of merger activity. The hypotheses are then assessed in light of the empirical results.

Mergers in perspective

The nature of mergers and the magnitude of merger activity have changed considerably over the past century. This section examines the evolution of the form of merger activity and compares the current increase in mergers with previous merger waves.

The nature of mergers

There are several kinds of mergers. A consolidation is the combination of many firms into a single new firm. This type of merger was typical of the merger wave of the 1890s. One of the best-known examples of a consolidation was the combining in 1901 of an estimated 785 firms into the United States Steel Corporation, the first U.S. industrial corporation with a capitalization of more than a billion dollars. As a result of antitrust legislation and associated court rulings, consolidations have virtually disappeared. They have been replaced by acquisitions of one corporation by another or by a group of investors.

Do mergers have detrimental effects on the macroeconomy?

Economists distinguish between horizontal, vertical, and conglomerate mergers. A horizontal merger is a union of firms selling the same product—that is, a combination of previously competing corporations. Horizontal mergers draw the most attention from regulatory agencies because they directly reduce the number of competitors. A vertical merger joins a supplier and one of its customers. An example is the purchase of a steel company by an automaker. A conglomerate merger is a combination that does not fit into either of the other two categories. The simplest type of conglomerate merger is one that combines completely unrelated firms. The purchase of the Otis Elevator Company by United Aircraft was an example of a pure conglomerate merger.

Mergers are financed in various ways. Sometimes the acquiring and target firms sim-

[3] For examples of this view, see Ralph L. Nelson, *Merger Movements in American Industry, 1895-1956*, Princeton University Press, 1959; Ralph L. Nelson, "Business Cycle Factors in the Choice Between Internal and External Growth," *The Corporate Merger*, eds., William W. Alberts and Joel E. Segall, University of Chicago Press, 1966; and Ronald W. Melicher, Johannes Ledolter, and Louis J. D'Antonio, "A Time Series Analysis of Aggregate Merger Activity," *The Review of Economics and Statistics*, Vol. 65, no. 3, August 1983, pp. 423-430.

[4] See, for example, *The Sommers Letter*, September 19, 1985.

ply swap shares at a mutually agreed-on price. Most target firms receive a combination of cash, debt, and equity in the acquiring firm. The simplest and most effective way of acquiring a firm is to offer to pay cash for all outstanding shares. This approach has been popular in recent years, even for very large acquisitions, in the form of the *leveraged buyout*. In this type of deal, a group of investors, often the managers of the target firm, borrow almost all of the cash needed to purchase the target firm. Below-investment grade bonds, so-called "junk bonds," are often used to finance leveraged buyouts. This mechanism has opened the merger market to a broader range of participants and weakened the defenses of target firms that want to stay independent.

Previous merger waves

The first two U.S. merger waves were composed largely of horizontal mergers. The wave of the 1890s was characterized by mergers that often openly sought to create monopolies. The Sherman Act of 1890 was intended to outlaw this behavior. It was not until the Supreme Court ruled in favor of the government, however, in the 1904 *U.S. vs. Northern Securities Company* case that mergers were eliminated as a means of evading the law.[5] Accordingly, the horizontal mergers of the 1920s produced oligopolies—that is, firms that claimed a significant share of the market but less than an outright monopoly.

The passage of the Celler-Kefauver Act of 1950 further discouraged horizontal and vertical mergers. As a result, most of the mergers since World War II have been conglomerate mergers. It has been estimated that where 50.4 percent of the mergers during the 1948-53 period were conglomerate mergers, the proportion in 1973-77 was 79.1 percent.[6]

The recent merger boom

The 1980s have seen the revival of the horizontal merger. The four largest mergers in 1984, with a total value of $33.6 billion, were acquisitions of oil companies by other oil companies. Mergers of airline companies and media companies also have become prevalent. Specific decisions by the Federal Trade Commission (FTC) and a general movement toward deregulation appear to be responsible for this trend.

The most notable feature of the recent boom has been the increase in the number of mergers involving very large firms. Table 1 documents this increase. The average value of a merger transaction—the average value of all the assets paid for an acquired firm—rose from $56 million (1982 dollars) in 1979 to $81 million in 1984. Evidence of this increase in the size of the average merger also appears in the ratio of the dollar value of all mergers to the dollar value of common and preferred stock of all publicly traded domestic firms. This ratio climbed from less than 2 percent in 1975 to almost 8 percent in 1984, a level that exceeds the 1969 value.[7]

The number of firms involved in mergers has not increased as rapidly as the value of the assets exchanged in mergers. Even though the

[5] The key statutes affecting the first two merger waves were the Sherman Act of 1890, which prohibited monopolization, attempts to monopolize, and actions in restraint of trade; the Clayton Act of 1914, which extended and modified the Sherman Act; and the Federal Trade Commission Act of 1914, which, among other things, established the Federal Trade Commission.

[6] These figures are taken from F. M. Scherer, *Industrial Market Structure and Economic Performance*, Rand McNally College Publishing Company, 1980, p. 124.

[7] These figures are reported in Mack Ott and G. J. Santoni, "Mergers and Takeovers—The Value of Predator's Information," *Review*, Federal Reserve Bank of St. Louis, Vol. 67, no. 10, December 1985, p. 18.

TABLE 1
Mergers and acquisitions of U.S. corporations

Year	Number	Total Value* (millions of 1982 dollars)	Average Value* (millions of 1982 dollars)
1979	1,526	85,103	56
1980	1,568	89,153	57
1981	2,326	137,062	59
1982	2,295	125,394	55
1983	2,344	114,504	49
1984	2,999	242,135	81
1985†	2,291	165,842	72

* The value of a merger is the value of all consideration paid for the acquired interest.
† First three quarters.

Source: These figures are taken from the database compiled by *Mergers and Acquisitions* magazine. They include purchases of U.S. corporations by other U.S. companies and by foreign companies where the total value of cash, capital stock, and debt paid for the acquired company is at least $1 million. Partial acquisitions of 5 percent or more of a company's capital stock are included. The total value is the value of those transactions for which a value was recorded adjusted for the percentage of transactions where no value was recorded. In these data, a value was recorded for between 40 and 60 percent of the mergers in each period. The average fraction of deals with known values was 48 percent.

number of mergers nearly doubled between 1979 and 1984, the 2,999 mergers in 1984 still fell short of the postwar peak of 3,012 mergers reached in 1969. Also, the rate of merger has remained fairly constant since the mid-1970s at slightly less than ten mergers per 10,000 firms—a rate far below the 1969 peak rate of 25 mergers per 10,000 firms.[8]

Mergers and the macroeconomy

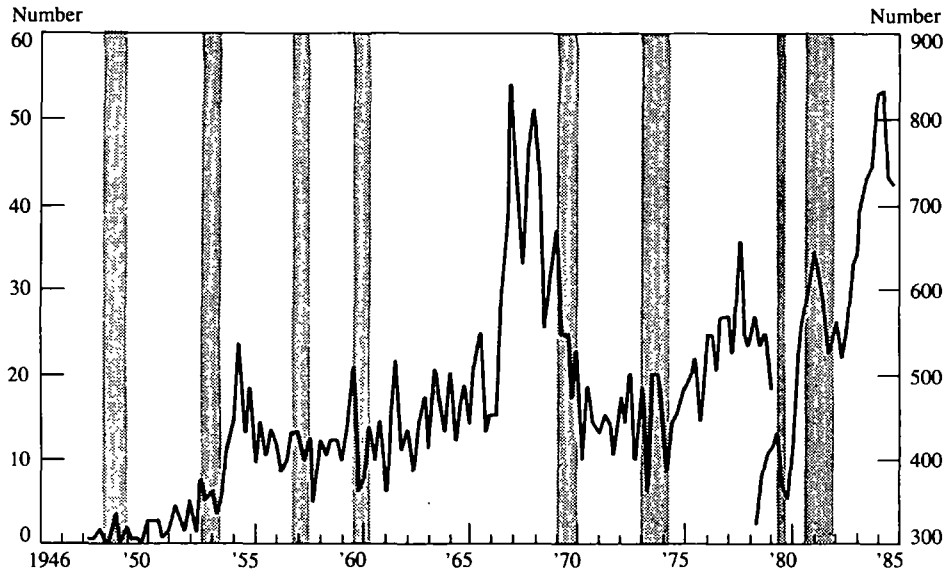
A casual examination of the past 40 years of mergers reveals that merger activity is strongly related to the business cycle. Chart 1 illustrates this phenomenon by using two different measures of the number of mergers. The data for the 1948-79 period come from the FTC's tabulation of mergers of large mining and manufacturing firms. The data for the 1979-85 period come from a database compiled by *Mergers and Acquisitions* magazine. The time period is separated into expansion and recession phases of the business cycle with the shaded regions indicating recessions.

Chart 1 reveals two important features. First, the number of mergers appears to be procyclical. Mergers typically increase during expansions and decrease during recessions. Second, the increase in merger activity appears to reach its peak before the peak of the business cycle expansion; that is, merger activity begins to decline before GNP reaches its peak. Note particularly the early peak in the number of mergers during the expansion in the mid-1950s, during the long expansion in the 1960s, and during the 1975-80 expansion.

A more detailed look at the data helps quantify the different behavior of mergers over the business cycle. In the period from 1948 to

[8] See Ott and Santoni, "Mergers and Takeovers. . . ."

CHART 1
Mergers and acquisitions of U.S. corporations
(By quarters)



Note: The data for the years 1948-79, measured on the left scale, come from the Federal Trade Commission's tabulation of mergers of large mining and manufacturing firms reported in the FTC's *Statistical Report on Mergers and Acquisitions* for various years. The data for the years 1979-85, measured on the right scale, come from the database compiled by *Mergers and Acquisitions* magazine. This database includes many more mergers than are reported in the FTC's counts. Shaded areas indicate periods of recession.

1979, the number of mergers increased at an average annual rate of 6.9 percent.[9] This growth rate rose to 10.6 percent during expansions and fell to 6.1 percent during recessions. The real-dollar value of mergers grew at an average annual rate of 13.2 percent over the entire 1948-79 period. The rate of growth of the dollar value rose to 15.6 percent during expansions, while the dollar value declined at a rate of 13.0 percent during recessions.

This association between mergers and the business cycle also is evident in the current merger boom. The average annual rate of growth in the number of mergers from 1979 to 1985 was 12.6 percent. The number of mergers increased 18.0 percent a year during expansions and declined 18.1 percent a year during recessions. The real-dollar value of mergers grew at an annual rate of 18.0 percent for the entire period. The dollar value grew at a rate of 42.5 percent during expansions and fell at a rate of 16.7 percent during recessions.

Observers have advanced several explanations for the procyclical behavior of mergers. Some have focused on the linkages running

[9] The growth rates for 1948 through 1979 are calculated from the data series on large mergers in mining and manufacturing reported in the Federal Trade Commission, *Statistical Report on Mergers and Acquisitions*, various years. The growth rates for 1979 through 1985 are calculated from the data in the database compiled by *Mergers and Acquisitions* magazine.

from financial markets and real activity to the behavior of mergers. In this view, the procyclical movement in merger activity is largely a reflection of the underlying business cycle. There is considerable uncertainty, however, about which cyclical factors have the strongest influence on mergers. More recently, other observers have asked whether there might be important linkages running in the opposite direction—from mergers to real and financial activity. Thus, some have raised concerns over the possible detrimental effects of mergers on the economy.

A casual examination of the past 40 years of mergers reveals that merger activity is strongly related to the business cycle.

The remainder of this section summarizes some of the principal hypotheses concerning the linkages between mergers and the business cycle. None of these hypotheses has so far achieved the status of a generally accepted theory, and the theoretical justifications for these hypotheses vary greatly. For convenience of exposition, these explanations are grouped into two categories: linkages between mergers and financial markets and linkages between mergers and real activity.

Mergers and financial markets

Events in financial markets may influence merger activity either by changing the profitability of mergers or by changing the stock of liquid assets available for mergers. Movements in interest rates and stock prices fall into the first category; they change the profitability of mergers. Fluctuations in the stock of money and the stock of debt, on the other hand, directly affect the pool of funds on which merger demand can draw.

Changes in interest rates may affect the profitability of mergers. A significant number of corporate acquisitions are financed either wholly or partially with debt. As interest rates change, the cost of funds used in acquiring firms changes. Also, bond purchases are an alternative use for the cash that might be slated for corporate purchases. As a consequence, it might be expected that fluctuations in interest rates are related to fluctuations in merger activity. In particular, merger activity could be expected to decline as interest rates rise.

It is natural to consider the possibility of a link between conditions in the stock market and merger activity.[10] The primary reason for purchasing a company instead of merely holding some of its stock is the belief that the firm would be worth more managed by a new team or integrated into a larger concern. If, for some reason, the number of firms that are "undervalued" in this sense increases, the number of mergers will increase.[11]

The direction of the observed effect of stock price changes on merger activity depends on the time it takes to complete a merger. The decision to acquire a firm may be made when the target firm's stock price first dips below its presumed value after reorganization. If the merger is consummated rapidly, then the historical record will show an inverse relationship between stock prices and mergers; that is, decreases in stock prices will precede increases in merger activity. If, as seems more likely, merger negotiations take substantial

[10] Links between the stock market and the volume of merger activity are considered in Nelson, *Merger Movements in American Industry, 1895-1956*, 1959 and "Business Cycle Factors in the Choice...," 1966, and in Melicher, Ledolter, and D'Antonio, "A Time Series Analysis...," 1983.

[11] Some observers also have argued that institutional changes in capital markets were necessary preconditions for particular merger booms, especially for the first two merger booms.

time and if, during that time, speculators bid up the price of the target firm on the basis of the expected merger, then a positive relationship between stock prices and mergers will be seen. Increases in stock prices will precede increases in merger activity.

Changes in the stock of money and debt may affect the volume of merger activity indirectly through their effect on interest rates. Changes in these monetary aggregates also may induce changes in the general availability of credit. Thus, to the extent that mergers are sensitive to credit availability, changes in monetary aggregates may have an effect on mergers independent of their influence on interest rates.

It has been conjectured that fluctuations in merger activity may also influence conditions in financial markets. Stock prices, for example, may react to changes in the number of mergers. First, changes in ownership may drive prices up by heralding more profitable operations in the future. Second, a rash of mergers may convince investors that more mergers are coming and thus may persuade them to buy shares in the hope of being bought out later at a premium price. Third, to the extent that mergers are financed with cash and debt, the supply of shares may temporarily decline. This reduction in supply may lead to a general, though temporary, increase in the price of shares as investors try to replace them in their portfolios.

Some observers have worried that the merger-fueled demand for credit might drive up interest rates and discourage borrowing for other kinds of investment. There appears to be little theoretical basis for this concern. After all, the original shareholders will reinvest the borrowed funds that are used to buy them out. In addition, merger-related borrowing has never been a large part of all borrowing. In any event, if the purchase and restructuring of firms increases profits enough to cover the cost of the borrowed funds, it is economically efficient to divert funds to mergers and away from less profitable investments.

A few observers have suggested that the merger-driven demand for funds has upset the normal relationship between the stock of money and other economic variables. Albert Sommers, the former chief economist of the Conference Board, has speculated that the recent poor performance of traditional models of money demand may be partly due to the financing of the current merger boom.[12]

Mergers and real activity

From the point of view of the acquiring firm, a merger has many of the same characteristics as an investment in new plant and equipment. As a result, merger activity, like other forms of investment, should increase when aggregate demand is expected to increase. Current shifts in real activity often signal future shifts in aggregate demand. Therefore, it is reasonable to suspect that changes in real activity may also signal changes in the volume of mergers. Because the important factor here is the market's expectation of future demand, the precise timing between changes in real activity and changes in mergers is difficult to predict.

An important difference between a merger and a purchase of new plant and equipment is that a firm's output is expanded more rapidly with a merger than with traditional investment expenditures. This difference in the rate at which output can be expanded is greatest when the economy is producing near its capacity and the lags between the order and the delivery of new plant and equipment are long. This difference suggests that merger activity

[12] See, for example, *The Sommers Letter*, September 19, 1985.

may move differently from investment expenditures when firms, on average, expect higher demand in the future and when the capacity utilization rate also is high.

Many analysts believe that mergers allow the assets of acquired firms to be directed toward more profitable activities. If this is so, a general increase in the number of mergers should lead to an increase in aggregate productivity and thus to an increase in aggregate output. Of course, the reorganization of an acquired firm takes time, so any increase in output will occur only after some time.

A statistical analysis of aggregate merger activity

This section analyzes the statistical relationship between merger activity and a set of macroeconomic variables to assess the explanations for the tendency of mergers to be procyclical. First, the evidence from previous research is reviewed. Then, a method of modeling mergers is discussed. And finally, the results of analyzing this merger model are presented.

Previous work on mergers and macroeconomic activity

The academic literature on mergers contains a few scattered results on the relationship between merger activity and the business cycle. Ralph Nelson considers mergers to be just another form of investment available to the acquiring firm.[13] He compares the "external" investment of a merger to the more familiar "internal" investment in additional plant and equipment. He finds that the number of mergers is associated with investment in plant and equipment, the level of stock prices, and industrial production. In the analysis of timing, he finds suggestions that upswings in mergers precede both upswings in investment in plant and equipment and, with a longer lag, upswings in stock prices. Nelson also reports that peaks in the number of mergers precede business cycle peaks. He concludes that the number of mergers is a leading indicator of economic activity particularly during expansions.

A more recent study by Melicher, Ledolter, and D'Antonio also finds that merger activity is positively correlated with industrial production and stock prices.[14] The authors claim that the number of mergers changes after stock prices change rather than before. In addition, they find that changes in bond yields help predict changes in the number of mergers.

Modeling mergers

Two statistical models are used here to analyze the linkages between mergers and the macroeconomy. The equations in these models are summarized in Table 2. The first model measures the linkages from real and financial activity to mergers. The equations in this model measure the association between current measures of merger activity and past values of macroeconomic variables. A finding of a statistically significant association between mergers and a particular macroeconomic variable in these regressions indicates that fluctuations in that particular variable precede fluctuations in mergers. Hence, the behavior of this macroeconomic variable helps predict merger activity.[15]

[13] See Nelson, *Merger Movements in American Industry, 1895-1956*, 1959 and "Business Cycle Factors in the Choice...," 1966.

[14] See Melicher, Ledolter, and D'Antonio, "A Time Series Analysis...," 1983.

[15] The finding that past values of one variable are significantly associated with current values of a second variable does not establish that changes in the first variable cause changes in the

TABLE 2
Merger equations

Model I: Linkages from real and financial activity to mergers

$$N_t = a + b_1(L)SP500_{t-1} + b_2(L)TBILL_{t-1} + b_3(L)DEBT_{t-1} + b_4(L)M1_{t-1} + b_5(L)CAPUT_{t-1} + b_6(L)GNP_{t-1} + e_t$$

$$V_t = a + b_1(L)SP500_{t-1} + b_2(L)TBILL_{t-1} + b_3(L)DEBT_{t-1} + b_4(L)M1_{t-1} + b_5(L)CAPUT_{t-1} + b_6(L)GNP_{t-1} + e_t$$

Model II: Linkages from mergers to real and financial activity

$$X_t = a + b_1(L)SP500_{t-1} + b_2(L)TBILL_{t-1} + b_3(L)DEBT_{t-1} + b_4(L)M1_{t-1} + b_5(L)CAPUT_{t-1} + b_6(L)GNP_{t-1} + b_7(L)N_{t-1} + e_t$$

$$X_t = a + b_1(L)SP500_{t-1} + b_2(L)TBILL_{t-1} + b_3(L)DEBT_{t-1} + b_4(L)M1_{t-1} + b_5(L)CAPUT_{t-1} + b_6(L)GNP_{t-1} + b_7(L)V_{t-1} + e_t$$

Definitions:

N_t = Number of mergers

V_t = Value of consideration paid for acquired firms

$SP500_t$ = Standard and Poor's comprehensive index of stock prices

$TBILL_t$ = Yield on 3-month Treasury bills

$DEBT_t$ = Domestic nonfinancial debt

$M1_t$ = M1 measure of the stock of money

$CAPUT_t$ = Capacity utilization rate

GNP_t = Gross national product

X_t = Any one of the macroeconomic variables, i.e., any one of the following: $SP500_t$, $TBILL_t$, $DEBT_t$, $M1_t$, $CAPUT_t$, or GNP_t

e_t = Zero mean, finite variance error

a = Constant

$b_i(L)$ = Fourth-order unrestricted polynomial in the lag operator L

Note: The Standard & Poor's index and capacity utilization rate are in logs; the Treasury bill yield is the ex-post real yield; and debt, M1, and GNP are in log billions of 1982 dollars.

The second model measures the linkages from mergers to real and financial activity. In this model, the associations between current values of macroeconomic variables and measures of past merger activity are calculated. The finding of a statistically significant association between mergers and a macroeconomic variable here indicates that merger activity may influence that macroeconomic variable. Lagged values of macroeconomic variables are included as explanatory variables in these equations to ensure that the estimated effect of the merger variables isolates the independent influence of merger activity. These lagged macroeconomic variables account for the influence of swings in economic activity that might simultaneously affect mergers and real and financial variables.

Two measures of merger activity are used: the number of mergers in a quarter and the value of all assets given in exchange for acquired firms in a quarter. The data on merger activity come from two sources. Data for the 1960-79 period were taken from the FTC's large merger series. (See footnote 9.) The data for later years were taken from the database compiled by *Mergers and Acquisitions* magazine.[16] The latter measure, the aggregate value of mergers, is theoretically more appropriate. However, reliable information on this value cannot be obtained for many mergers. Because the number of mergers is reported more accurately, it is a useful indicator of the volume of merger activity. Six macroeconomic variables are included in the analysis: the Standard & Poor's comprehensive index of stock prices, the yield on 3-month Treasury bills, the stock of money, the stock of domestic nonfinancial debt, the capacity utilization rate, and GNP.

It is possible to distinguish in these two models between short-run and long-run associations between variables. A significant short-run association between an explanatory variable and the variable being modeled means that a temporary deviation from the average value in the explanatory variable helps predict future temporary movements in the variable being modeled. A significant long-run association means permanent shifts in the level of the explanatory variable predict permanent changes in the level of the variable being modeled.[17]

Macroeconomic determinants of mergers

Table 3 reports estimates of the short-run and long-run associations between mergers and macroeconomic variables in the model where the linkages run from real and financial variables to merger activity. Estimates of this model suggest that macroeconomic variables account for about one-third of the fluctuations in merger activity.[18] Thus, two-thirds of the fluctuations in merger activity can be regarded as due to factors not captured in this model.

second variable. It is always possible that there are other variables omitted from the analysis that are the cause of the fluctuations in both the variables being analyzed. However, if there is a plausible theory that predicts a statistically significant association between these two variables, then confirming that association lends credence to the theory.

[16] The FTC data include mergers of large firms in mining and manufacturing. The data from *Mergers and Acquisitions* magazine contain information on mergers of firms in all industries and also include mergers of much smaller firms. These two series were made comparable by first eliminating the part of each series that can be explained by its own recent past. The remaining portion of each series was normalized and the series were combined.

[17] Formally, the joint significance of the lag coefficients is regarded as a significant short-run association. The significance of the sum of the lag coefficients is regarded as a significant long-run association.

[18] The R^2 statistic for the regression of the number of mergers against macroeconomic variables is 0.32. The R^2 statistic for the regression of the value of mergers against macroeconomic variables is 0.34. Note that the portion of merger fluctuations that could be predicted solely on the basis of past merger activity was removed from these merger measures before the equations were estimated.

TABLE 3
Estimated merger equations: Model I
(Tests for the influence of macroeconomic variables on merger activity)

	Dependent Variable			
	Number of mergers†		Value of mergers‡	
Explanatory Variable	Short run	Long run§	Short run	Long run§
SP500				
F-statistic	4.38	0.39 (+)	1.52	4.80* (+)
TBILL				
F-statistic	2.54*	7.53* (-)	1.54	2.28 (-)
DEBT				
F-statistic	2.73*	2.00 (+)	0.87	3.17* (+)
M1				
F-statistic	0.90	0.42 (-)	1.96	2.43 (-)
CAPUT				
F-statistic	2.36*	2.47 (+)	2.54*	0.17 (+)
GNP				
F-statistic	1.50	4.38* (-)	3.82*	3.35* (-)

* Asterisks indicate relationships that are statistically significant at the 10 percent level.
† 1960:Q1-1985:Q3
‡ 1961:Q4-1985:Q3
§ Plus and minus signs in parentheses indicate the sign of the long-run effect.

Note: The figures in this table are the F-statistics for the tests of the hypotheses that each of the macroeconomic variables influences merger activity.

These factors may include changes in regulations, innovations in capital markets, and technological advances that alter the competitive positions of existing firms.

As was noted above, changes in the interest rate affect the cost of mergers by changing the cost of borrowed funds. Changes in interest rates also affect the attractiveness of mergers by changing the return to lending cash instead of using it for acquisitions. In these data, the number of mergers is strongly affected by changes in the yield on 3-month Treasury bills. Both short-run and long-run increases in this yield depress the number of mergers. As shown in Table 3, the F-statistic for the short-run effect of Treasury bills on the number of

mergers is 2.54, which implies that this effect is statistically significant at the 10 percent level. The F-statistic for the long-run effect is 7.53, which implies that the long-run effect also is significant at the 10 percent level. Given the strength of this relationship between the Treasury bill yield and the number of mergers, it is surprising that there is no significant influence of this yield on the value of mergers. However, reports of the value of mergers are less complete and less reliable than reports of the number of mergers. This could account for the lack of a significant association.

The idea that firms are acquired because the value of their shares is less than the price they might command after a merger has gained acceptance. Other researchers have extended this notion to include the possibility that, in this sense, average stock prices may be too low and, therefore, may induce a rash of mergers. As was pointed out above, Nelson and Melicher, Ledolter, and D'Antonio found some statistical evidence of a positive association between the average level of stock prices and merger activity.[19] Nelson's evidence suggested that mergers precede movements in stock prices, while Melicher, Ledolter, and D'Antonio's evidence suggested the opposite—that stock price movements precede merger activity.

These data show the positive relationship between stock prices and mergers found by Melicher, Ledolter, and D'Antonio; that is, rises and falls in stock prices precede rises and falls in merger activity. However, in contrast to their findings, this relationship is not statistically significant. In the short run, fluctuations in both the number and value of mergers are unrelated to fluctuations in the stock market. Permanent increases in the index of stock prices are significantly associated with increases in the value of mergers. However, this relationship probably reflects the fact that acquisitions cost more when the market value of all firms is higher.

It was suggested earlier that fluctuations in the stocks of money or nonfinancial debt might affect merger activity because they imply changes in the pool of liquid assets available for corporate acquisitions. In these data, the stock of debt exhibits a puzzling relationship with merger activity. In the short run, increases in debt lead to reductions in the number of mergers. In the long run, however, such increases lead to increases in the aggregate value of mergers. The increase in the value of mergers in the long run may reflect strategic behavior on the part of acquiring and target firms. Acquiring firms may sell bonds to accumulate a "war chest" of cash. Potential target firms may take on debt to repurchase their own shares and to make themselves less attractive to acquirers. The short-run association between debt and the number of mergers is not easy to explain.

There is no evidence in these data of any relationship between mergers and the stock of money as measured by M1, the sum of currency and checkable deposits. Both in the short run and the long run, the number and value of mergers are unaffected by changes in M1.

These data support the notion that mergers are best understood as an alternative to purchases of new plant and equipment, an idea advanced by Nelson.[20] Short-run changes in the capacity utilization rate lead to significant changes in both the number and the value of mergers. This result is in accord with the

[19] See Nelson, *Merger Movements in American Industry, 1895-1956*, 1959 and "Business Cycle Factors in the Choice...," 1966, and Melicher, Ledolter, and D'Antonio, "A Time Series Analysis...," 1983.

[20] See Nelson, "Business Cycle Factors in the Choice...," 1966.

notion that firms regard mergers as a way of speeding up the increase in capacity normally achieved through construction of new plants and purchases of equipment. Fluctuations in the capacity utilization rate appear to have no long-run effects on merger activity. The absence of any long-run impact is also consistent with the view that mergers and capital investment are regarded as substitutes by the firm. In the long run, only new investment can satisfy an aggregate desire to increase production.

Both the research by Nelson and the series displayed in Chart 1 suggest that peaks in merger activity come before peaks in general economic activity. In other words, increases in real GNP precede declines in the number and value of mergers. This timing relationship is confirmed by the figures in Table 3. Current changes in GNP show a significant negative association with future changes in merger activity.

Do mergers have macroeconomic effects?

In addition to looking at the macroeconomic determinants of mergers, some economists have emphasized the linkages running from mergers to macroeconomic activity. Thus, some research has suggested that merger activity may be a leading indicator of movements in stock prices or real activity.[21] More recently, attention has focused on the possibly detrimental effects of mergers on financial markets. Members of Congress have asked the Board of Governors of the Federal Reserve System whether merger-related demand for credit might drive up interest rates and discourage other business borrowing.

Questions also have been raised about whether merger activity might distort the behavior of the monetary aggregates that the Federal Reserve uses in guiding monetary policy. During 1985, the narrowly defined transactions measure M1 exceeded its target range, while the broader domestic nonfinancial debt measure grew above its monitoring range in both 1984 and 1985. Some have attributed a portion of excessive growth in these aggregates to merger activity.[22]

To examine the linkages running from mergers to the macroeconomy, the equations listed in Model II were estimated over the 1960-85 time period. This model tries to explain the behavior of such macroeconomic variables as interest rates, money, stock prices, and GNP in terms of previous values of the number or value of mergers as well as previous values of the macroeconomic variables. Table 4 reports F-statistics for the two merger variables in each of the equations explaining the macroeconomic variables. In each case, the effect of the merger variables is statistically insignificant. That is, neither the number of mergers nor the value of mergers makes a statistically significant contribution to the explanation of the behavior of the macroeconomic variables. Thus, over the 1960-85 period, there does not appear to be a measurable feedback effect of mergers on real or financial activity.

In evaluating these results, however, it is important to remember that the model used here is designed to reveal systematic associations that have remained stable over the last two-and-a-half decades. There may have been specific historical episodes where merger activity had a temporary impact on specific real or financial variables, but such episodes are difficult to model. The results of this study

[21] See, for example, Nelson, *Merger Movements in American Industry, 1895-1956*, 1959 and "Business Cycle Factors in the Choice...," 1966, and Melicher, Ledolter, and D'Antonio, "A Time Series Analysis...," 1983.

[22] See, for example, *The Sommers Letter*, September 19, 1985.

TABLE 4
Estimated merger equations: Model II
(Tests for the influence of merger activity on macroeconomic variables)

Explanatory Variable	Dependent Variable					
	SP500	TBILL	DEBT	M1	CAPUT	GNP
Number of mergers*						
Short run	1.72	0.20	0.60	0.24	0.71	0.18
Long run	1.58	0.66	0.28	0.58	0.63	0.54
Value of mergers†						
Short run	0.98	1.18	0.24	0.39	0.45	0.78
Long run	0.11	0.66	0.22	0.10	1.31	0.01

* 1960:Q1-1985:Q3
† 1961:Q4-1985:Q3

Note: The figures in this table are the F-statistics for the tests of the hypotheses that merger activity influences each of the macroeconomic variables. None of the F-statistics are significant at the 10 percent level.

do suggest, though, that care should be exercised in extrapolating these episodes into a systematic linkage from mergers to economic activity.

Conclusions

This article examined the relationship between merger activity and the business cycle. During the last four decades, merger activity has been strongly procylical, growing more rapidly during expansions and more slowly during recessions. The empirical analysis in this article measured the extent to which aggregate cyclical fluctuations have accounted for the variations in merger activity and identified the macroeconomic variables that have been most responsible for changes in merger activity. The analysis also examined the recent conjecture that mergers disrupt the normal functioning of the macroeconomy, particularly of credit markets.

About a third of the variation in aggregate merger activity can be attributed to changes in macroeconomic conditions. Of the macroeconomic factors considered, changes in real interest rates appear to have the greatest influence on merger activity. This influence may reflect the dependence of acquiring firms on debt financing. Capacity utilization also affects merger activity in the short run, indicating that firms may choose to expand through acquisitions rather than through traditional investments in plant and equipment when there are substantial delays in obtaining delivery of new capital goods.

In contrast, macroeconomic variables seem utterly unresponsive to any change in the volume of mergers. Mergers show no systematic impact on interest rates or on debt levels, two variables for which a relationship has been hypothesized. Thus, concerns that merger activity may have detrimental effects on the macroeconomy do not appear to be justified.

Market Perceptions Of U.S. Monetary Policy Since 1982

By V. Vance Roley

Most market observers agree that Federal Reserve monetary policy operating procedures changed in October 1982, if not before. Views differ, however, about the type of policy implemented since the change. The most common interpretation is that the Federal Reserve adopted an operating procedure designed to stabilize short-term interest rates and abandoned narrowly defined money, M1, as a policy target. Indeed, some analysts apparently believe that the Federal Reserve returned to the procedure in effect before October 1979.

This article examines the behavior of interest rates to infer market perceptions of monetary policy. Three aspects of interest rate behavior are considered. First, the volatility of interest rates since 1982 is compared with the volatility of previous periods. The relative volatility across periods provides evidence on the type of operating procedure adopted. Second, the response of interest rates to the Federal Reserve's weekly money announcements is estimated. These estimates provide evidence on both the type of operating procedure and the emphasis on M1 targets. Third, the response of interest rates to new information about inflation and economic activity is empirically examined. These estimates allow further insight about the role of M1 targets in monetary policy.

The results of this article suggest that the behavior of interest rates since 1982 is consistent with an operating procedure different from that of the late 1970s. It is also argued that the behavior of interest rates is consistent with a diminished role for M1 in monetary policy. The evidence also supports the notion that information about economic activity and inflation has assumed increased importance in the recent conduct of monetary policy.

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Factors differentiating monetary policy regimes

Monetary policy regimes are defined in this article in terms of Federal Reserve operating procedures and the emphasis placed on M1 targets. The operating procedures are classified into three stylized types—the federal funds rate, nonborrowed reserves, and borrowed reserves procedures. In conducting monetary policy, the short-run operating target differs depending on the operating procedure. Under the federal funds rate procedure, the Federal Reserve attempts to maintain the federal funds rate at a certain level for a given period, such as a week. Similarly, under the nonborrowed reserves procedure, the path for nonborrowed reserves is maintained over a given short-run period. Finally, under the borrowed reserves procedure, borrowings from the Federal Reserve's discount window are kept relatively stable.

In addition to being classified by operating procedures, monetary policy regimes are characterized by the emphasis on M1 targets. Under any procedure, the behavior of both the federal funds rate and longer term yields will differ over time depending on the degree of monetary control desired. So, both different operating procedures and different emphases on monetary targets imply different interest rate behavior.

To identify monetary policy regimes, three aspects of interest rate behavior are considered in some detail in this section. These aspects are the volatility of interest rates, the response of interest rates to weekly M1 announcements, and the response of interest rates to new information about inflation and economic activity. In brief, the federal funds rate should be most volatile under the nonborrowed reserves procedure, least volatile under the federal funds rate procedure, and somewhere between these two cases under the borrowed reserves procedure. The volatility of longer term yields should partly reflect the volatility of the federal funds rate and the emphasis on achieving the monetary targets in future weeks. In terms of interest rate responses to new information in weekly M1 announcements, the federal funds rate should not respond under the federal funds rate and borrowed reserves procedures. The federal funds rate should respond, however, under the nonborrowed reserves procedure. The response of longer term yields depends to some extent on the response of the federal funds rate. The response of longer term yields depends primarily, however, on the emphasis the Federal Reserve and market participants place on M1 targets. More specifically, the relative response of longer term interest rates to money announcements and announcements concerning inflation and economic activity indicates the market's perception of the relative importance of these factors in monetary policy.

The remainder of this section describes theoretical considerations regarding the volatility of interest rates, the response of interest rates to weekly M1 announcements, and the response of interest rates to new information about inflation and economic activity. These factors are then used in the next section to characterize four possible monetary policy regimes since the late 1970s.

Volatility of interest rates

The volatility of the federal funds rate—an overnight rate in the bank reserves market—depends on disturbances affecting the market for reserves, Federal Reserve intervention in the reserves market through open market operations, and the market's perception of the type of operating procedures being used. If the market believes that the Federal Reserve will

offset shocks affecting the reserves market through open market operations, the federal funds rate will be relatively stable over a short period, such as a week. If disturbances in either the demand for or supply of reserves are not offset, however, the market will act on that information and the federal funds rate will move to clear the reserves market. Different operating procedures imply different behavior for the federal funds rate through these channels.

For a given monetary disturbance, the greater the Federal Reserve's commitment to achieve a particular monetary target, the greater the coinciding fluctuation in longer term yields.

The volatility of other interest rates, such as the 3-month Treasury bill yield, also depends on the type of operating procedure employed by the Federal Reserve, although to a less extent. The 3-month Treasury bill yield depends on both the current federal funds rate and the rate expected in future weeks.[1] If the current week's federal funds rate fluctuates, then some of this volatility is reflected in the Treasury bill yield.

Treasury bill yields also fluctuate if financial market participants change their assessments about the federal funds rate in future weeks. Monetary targets are important in examining this link.[2] If new information suggests, for example, that the money stock will be higher than previously expected, the Treasury bill yield may rise if the market expects the Federal Reserve to offset this unexpected increase. In this instance, the market expects the Federal Reserve to attempt to achieve a particular monetary target. Alternatively, if the Federal Reserve places little or no weight on a particular monetary target, the market will expect future levels of the federal funds rate to be as previously predicted. So, for a given monetary disturbance, the greater the Federal Reserve's commitment to achieve a particular monetary target, the greater the coinciding fluctuation in longer term yields.[3]

Response of interest rates to money announcements

The response of interest rates to the Federal Reserve's weekly M1 announcement also can be used to determine the market's perception of different monetary policy regimes. The response of the federal funds rate depends directly on the type of operating procedure employed by the Federal Reserve. In particular, the response depends on whether the corresponding shock to the market for reserves is offset. The reserves market is affected by unanticipated announced changes in M1 initially through the market's assessment of the

[1] Under the pure expectations model of the term structure of interest rates, the 3-month, or 13-week, Treasury bill yield can be approximately related to current and expected future values of the federal funds rate as

$$\Delta RTB_t = (1/13)[RFF_t + E(RFF_{t+1}) + \ldots + E(RFF_{t+12})],$$

where RTB_t is the 13-week yield, RFF_t is the federal funds rate in week t, and $E(RFF_{t+i})$ is the expected federal funds rate in week t + i as of week t.

[2] The Treasury bill yield depends on a number of other factors, most notably the level of expected inflation. This relationship is examined briefly below. For further analyses, see Bradford Cornell, "Money Supply Announcements and Interest Rates: Another View," *Journal of Business*, January 1983, pp. 1-24, and V. Vance Roley and Carl E. Walsh, "Monetary Policy Regimes, Expected Inflation, and the Response of Interest Rates to Money Announcements," *Quarterly Journal of Economics*, Supplement 1985, pp. 1011-1039.

[3] This assumes that the underlying shocks are the same. If the sizes of the shocks differ over periods, the volatility of interest rates also would change.

demand for required reserves. Required reserves depend on the level of bank deposits, the major component of M1. Under the lagged reserve requirements (LRR) system in effect before February 1984, required reserves depended on the level of the money stock two weeks previously, the statement week corresponding to the current week's money announcement data. Under the contemporaneous reserve requirements (CRR) system adopted in February 1984, required reserves depend on the current money stock, with a lag of several days. Also, reserve computation and maintenance periods are two weeks in length, while they lasted one week under LRR. Although the money announcement data under CRR do not coincide with the current reserve periods, unanticipated announced changes in M1 may still affect the demand for reserves if the unanticipated changes or surprises persist. That is, the current week's demand for reserves would be affected if a positive money surprise caused market participants to raise their assessment of the current week's money stock.[4]

The response of the Treasury bill yield to money announcement surprises can be used to determined whether the Federal Reserve is perceived to be attempting to achieve its M1 target.

The response of Treasury bill yields and other longer term yields to money announcement surprises depends partly on the response of the federal funds rate. Most of the response depends, however, on the extent to which the market expects the Federal Reserve to offset the shock in the future. Under CRR or LRR, the response is greater the more quickly the Federal Reserve acts to offset the money surprise in the future. So, the response of the Treasury bill yield to money announcement surprises can be used to determine whether the Federal Reserve is perceived to be attempting to achieve its M1 target.

Response of interest rates to inflation and economic activity announcements

The response of interest rates to new information about economic activity and inflation may operate through the same channels as money announcements if such information is related to money demand.[5] The demand for nominal money balances is usually thought to depend on the level of real activity and commodity prices. So, if either real economic activity or inflation is higher than expected, the market may raise its assessment of the current and future weeks' demand for money. Interest rates, then, would be expected to rise if the market did not expect the Federal Reserve to accommodate the increased demand.

The primary effect on interest rates is likely to depend on the direct value of information about the economy. In this case, if inflation is announced to be higher than expected, for example, policymakers may adopt more restrictive policies, causing interest rates to rise immediately. The effect could be the same for an unexpectedly large increase in eco-

[4] This analysis is different from that presented by William T. Gavin and Nicholas V. Karamouzis, "The Reserve Market and the Information Content of M1 Announcements," *Economic Review*, Federal Reserve Bank of Cleveland, Q1:1985, pp. 11-28. They apparently assume that money demand shocks are not autocorrelated. Also, as is discussed in the next section, autocorrelated money supply shocks emanating from the reserves market can affect the response of interest rates under CRR.

[5] For further discussion of the effect of economic information on interest rates, see V. Vance Roley and Rick Troll, "The Impact of New Economic Information on the Volatility of Short-Term Interest Rates," *Economic Review*, Federal Reserve Bank of Kansas City, February 1983, pp. 3-15.

nomic activity. Depending on the Federal Reserve's emphasis on this type of information, the response of interest rates may have varied over the different monetary policy regimes.

Monetary policy regimes

The factors related to interest rate behavior discussed in the previous section are used to differentiate four potential monetary policy regimes since the late 1970s. The four regimes correspond to the periods before October 1979, from October 1979 to October 1982, from October 1982 to February 1984, and after February 1984. These regimes are potentially different in terms of the Federal Reserve's operating procedures, its emphasis on M1 targets, and the reserve requirement systems.

Pre-October 1979

Before October 1979, the Federal Reserve used the federal funds rate, or money market conditions, operating procedure.[6] Under this procedure, the Federal Reserve offsets most shocks affecting the reserves market to keep the federal funds rate relatively stable over a given period, such as a week. If the federal funds rate is higher than desired, for example, the Federal Reserve adds nonborrowed reserves to the reserves market by purchasing Treasury securities. The increased supply of reserves causes the federal funds rate to fall.

Even under this procedure, the federal funds rate would be expected to exhibit some volatility over time. In particular, to offset deviations in money growth from its target, the Federal Reserve made discretionary changes in the rate. In turn, the expectation of future discretionary changes influenced the volatility of Treasury bill yields. Nevertheless, the Federal Reserve was often perceived before October 1979 as not quickly offsetting deviations in money growth, so the volatility of both the federal funds rate and Treasury bill yields was likely to be relatively low.

Under the federal funds rate procedure, the federal funds rate also should not respond to money announcement surprises. In this case, a positive money announcement surprise increases the market's assessment of the demand for reserves in the current week. The federal funds rate should not respond, however, because market participants expect the Federal Reserve to accommodate the shock initially in the market for reserves. Nevertheless, if market participants expect the Federal Reserve eventually to offset at least part of the unanticipated increase in money to achieve its monetary targets, Treasury bill yields will rise immediately. Moreover, if the Federal Reserve focused primarily on its monetary targets and not on direct information about the economy, new information about economic activity and inflation should not cause changes in Treasury bill yields.

October 1979-October 1982

In October 1979, the Federal Reserve replaced the federal funds rate operating procedure with the nonborrowed reserves, or reserves aggregate, procedure. Under this procedure, most disturbances affecting the reserves market, and therefore the federal funds rate, are not offset. Instead, the nonbor-

[6] For detailed discussions of these different operating procedures, see R. Alton Gilbert, "Operating Procedures for Conducting Monetary Policy," *Review*, Federal Reserve Bank of St. Louis, February 1985, pp. 13-21; and V. Vance Roley, "The Response of Interest Rates to Money Announcements Under Alternative Operating Procedures and Reserve Requirement Systems," *Proceedings of the Fall 1985 Academic Conference*, Federal Reserve Bank of San Francisco, forthcoming.

rowed reserves path is maintained over a given period and the federal funds rate fluctuates in response to shocks either to the demand for or supply of reserves. As a result, the federal funds rate would be expected to be more volatile under this procedure.

In addition to the increased volatility due to the procedure itself, the Federal Reserve indicated its desire to improve monetary control in October 1979. So, for a given deviation of money growth from its target, the likelihood of future discretionary changes in policy to offset the deviation may have increased. As a result, the volatility of both the federal funds rate and Treasury bill yields would be expected to be higher than before October 1979.

In terms of the specific monetary information provided by a positive money announcement surprise, for example, the federal funds rate should increase under the nonborrowed reserves operating procedure. This rise is due to a higher assessment of the demand for reserves that is not expected to be accommodated through Federal Reserve open market operations. In turn, Treasury bill yields partly reflect this increase in the federal funds rate. Moreover, if the Federal Reserve was offsetting monetary shocks more quickly and completely during this period, there would be a further response of Treasury bill yields. So, the responses of both the federal funds rate and Treasury bill yields to money announcement surprises should be greater than before October 1979. Given the focus on monetary targets under the October 1979-October 1982 regime, the effects of new information on economic activity and inflation would be expected to be minimal.

In comparison with the other procedures, the borrowed reserves procedure implies more short-run volatility in the federal funds rate.

October 1982-February 1984

Sometime around October 1982, the Federal Reserve replaced the nonborrowed reserves procedure with a borrowed reserves procedure.[7] Under the borrowed reserves procedure, the Federal Reserve can be characterized as attempting to achieve a certain level of discount window borrowing over a given period. An important determinant of discount window borrowing is usually thought to be the spread between the federal funds rate and the discount rate.[8] If the federal funds rate rises, for example, banks will find borrowing at the discount window more attractive because borrowed reserves can be obtained at less cost.

With the borrowed reserves procedure, unanticipated changes in either required or excess reserves are accommodated by changing nonborrowed reserves. If the demand for required reserves is higher than expected, for example, the federal funds rate rises initially and borrowing increases to equate supply and demand in the reserves market. To offset the increase in borrowing, nonborrowed reserves are increased until the federal funds rate falls to its previous level. In contrast, if a shock originating in the demand for borrowed reserves occurs in which borrowing is higher than expected at every level of the federal funds rate, this disturbance is at most partially offset and the federal funds rate falls. The decline in the federal funds rate serves to

[7] For a discussion of this change in operating procedures, see Henry C. Wallich, "Recent Techniques of Monetary Policy," *Economic Review*, Federal Reserve Bank of Kansas City, May 1984, pp. 21-30.

[8] See, for example, Gordon H. Sellon, Jr., "The Role of the Discount Rate in Monetary Policy: A Theoretical Analysis," *Economic Review*, Federal Reserve Bank of Kansas City, June 1980, pp. 3-15.

reduce the demand for borrowed reserves. So, this source of disturbances in the reserves market causes fluctuations in the federal funds rate. In comparison with the other procedures, the borrowed reserves procedure implies more short-run volatility in the federal funds rate than the federal funds rate procedure, in which most reserves market shocks are offset, and less volatility than the nonborrowed reserves procedure, in which most reserves market shocks are not offset.

The behavior of M1 during 1982 also continued to be difficult to interpret. As a result, the Federal Reserve deemphasized its target for M1 about the time it changed operating procedures. This factor would be expected to make both the federal funds rate and Treasury bill yields less volatile than in the October 1979-October 1982 period. The federal funds rate, however, would still be expected to be more volatile than it was before October 1979.

Because the Federal Reserve accommodates shocks to the demand for reserves under the borrowed reserves operating procedure, the federal funds rate should not respond to money announcement surprises. The response of the Treasury bill yield also would be expected to decline in this period. Part of the decline reflects the behavior of the current week's federal funds rate. More importantly, however, the response would have declined if the Federal Reserve placed less emphasis on its M1 targets. If the Federal Reserve placed more weight on direct measures of economic performance, Treasury bill yields may have become more responsive to new information about economic activity and inflation.

Post-February 1984

Another possible change in monetary policy regimes coincides with the Federal Reserve's adoption of contemporaneous reserve requirements in February 1984. In contrast to previous episodes, the change in regimes does not involve a change in operating procedures. The previous borrowed reserves procedure probably remained in effect. Instead, the change from lagged reserve requirements strengthened the link between the current week's money stock and the market for reserves. The short-run volatility of interest rates most likely remained about the same as in the previous regime, primarily because operating procedures apparently did not change.

Because of uncertainty about the effects of CRR and the continued problems in interpreting movements in M1, the emphasis placed on M1 may have been further reduced since February 1984. In turn, it is likely that the volatility of interest rates either remained about the same or declined slightly from the previous period. The main characteristic of the period after February 1984, however, does not concern interest rate volatility, but how new information about M1 affects interest rates.

The change in reserve requirement systems in February 1984 may have affected the response of interest rates to the new information provided by money announcements. Money announcement surprises under the previous LRR system predominantly reflected unanticipated shifts in the demand for money since reserves in any given week were tied loosely to the current week's money stock. The relationship is tightened considerably under CRR. As a consequence, money announcement surprises since February 1984 may reflect both money demand shocks and disturbances in the reserves market. These latter disturbances correspond to money supply shocks. In this case, if money demand and supply shocks are equally persistent, the money announcement surprise would not affect the federal funds rate under any operating procedure and the response of Treasury

bill yields would diminish considerably.[9] The response of Treasury bill yields also would decline if the Federal Reserve further deemphasized its M1 target. If that occurred, new economic information may have larger effects on Treasury bill yields.

Empirical evidence on monetary policy regimes

This section presents an empirical evaluation of the implied properties of the four possible monetary policy regimes since the late 1970s. The periods since October 1982 can be characterized more easily by first considering the regimes before October 1982. As in the theoretical discussion, the regimes are evaluated in terms of the volatility of interest rates, the response of interest rates to money announcements, and the response of interest rates to new information about inflation and economic activity.

Volatility of interest rates

The monetary policy regimes discussed in the previous section have distinct implications for the volatility of interest rates. As mentioned, the federal funds rate should exhibit the least variability under the federal funds rate procedure, the most under the nonborrowed reserves procedure, and volatility somewhere between these two cases under the borrowed reserves procedure. The volatility of Treasury bill yields should partly reflect the volatility of the federal funds rate, but a larger portion of the volatility can be attributed to changes in the market's expectation about future monetary policy. That is, for a given shock affecting the money stock, Treasury bill yields exhibit more volatility the greater the commitment of the Federal Reserve to offset the shock in the near future.

The volatility of the federal funds rate and the 3-month Treasury bill yield is examined over several periods in Table 1. Volatility is measured as the standard deviation of weekly percentage changes of the respective interest rates.[10] The periods correspond to the different monetary policy regimes. The first period begins in October 1977 and ends in October 1979, and it corresponds to the last two years of the federal funds rate procedure under LRR. The second period starts in October 1979 and ends in October 1982, representing the nonborrowed reserves procedure also under LRR.[11] The October 1982-February 1984 period coincides with the beginning of the borrowed reserves procedure under LRR. The final period is marked by the adoption of CRR in February 1984.

As indicated in the table, the volatility of the federal funds rate increased significantly from the pre-October period to the October 1979-October 1982 period. In particular, the volatility of the percentage change in the federal funds rate was 2.2 percentage points per week in the earlier period, compared with 7.6 percentage points in the October 1979-October 1982 period. This result is consistent with the Federal Reserve adopting a nonborrowed reserves procedure in the later period. The

[9] This result follows from the formal model presented by V. Vance Roley, "The Response of Interest Rates to Money Announcements Under Alternative Operating Procedures and Reserve Requirement Systems," *Proceedings of the Fall 1985 Academic Conference*, Federal Reserve Bank of San Francisco, forthcoming.

[10] Percentage changes are used to conform with a recent article by Robert H. Rasche, "Interest Rate Volatility and Alternative Monetary Control Procedures," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1985, pp. 46-63.

[11] Some evidence suggests that the change in operating procedures might have occurred earlier. See, for example, Jan G. Loeys, "Changing Interest Rate Responses to Money Announcements: 1977-1983," *Journal of Monetary Economics*, May 1985, pp. 323-332.

TABLE 1
Volatility of interest rates

Interest Rate	Standard Deviations of Weekly Percentage Changes*			
	Oct. 1977-Oct. 1979	Oct. 1979-Oct. 1982	Oct. 1982-Feb. 1984	Feb. 1984-Sept. 1985
Federal funds rate	0.022	0.076	0.040	0.044
3-month Treasury bill yield	0.026	0.057	0.025	0.021

*Percentage changes, PC, are computed as $PC = (R_t - R_{t-1})/R_{t-1}$, where R_t is the 3:30 p.m. interest rate quote on the day following the money announcement in week t (Source: Board of Governors of the Federal Reserve System, H.15). Standard deviations of percentage changes, SD, are defined as

$$SD = [(1/n-1) \sum_{t=1}^{n} (PC_t - \overline{PC})^2]^{1/2},$$

where n corresponds to the number of weeks in the period and $\overline{PC}$ is the average percentage change over the n-week period.

period beginning in October 1982 exhibited significantly less federal funds rate volatility, as expected if the Federal Reserve actually adopted a borrowed reserves procedure. Also as expected, the volatility of the federal funds rate during this period is significantly greater than before the October 1979 period.[12] The final period, coinciding with the adoption of CRR, exhibits approximately the same volatility as the immediately preceding period. *As a whole, the results are consistent with Federal Reserve statements about the adoption of different operating procedures.*

The volatility results for the Treasury bill yield are similar to those of the federal funds rate, with one exception. In particular, volatility declined beginning in October 1982 to about the same as in the pre-October 1979 period. The volatility of the Treasury bill yield should not, however, be as dependent on the type of operating procedure as the federal funds rate. The decline in volatility may instead reflect a reduced emphasis on monetary targets by both the Federal Reserve and market participants.

Response of interest rates to money announcements

To consider changes in operating procedures further, along with the possibility that M1 targets have a reduced role in monetary policy, the response of the federal funds rate

[12] These results are different from those reported by Robert H. Rasche, "Interest Rate Volatility and Alternative Monetary Control Procedures," *Economic Review*, pp. 46-63. He finds that the post-October 1982 volatility of the federal funds rate is not significantly different from that of the pre-October 1979 period. By starting the pre-October 1979 period in 1969, his measured volatility is significantly larger. The volatilities reported in the two post-October 1982 periods are very similar to those reported by Rasche. Tests that adjacent periods have the same variances of the federal funds rate yielded F-statistics of 11.76 with (155,104) degrees of freedom, 3.57 (155,68), and 1.19 (86,68). The alternative hypotheses were that the variance in the October 1979-October 1982 period was greater than the variances in the pre-October 1979 and October 1982-February 1984 periods, and the variance in the second post-1982 period was greater than that of the first. Thus, only in the two post-October 1982 periods could the hypothesis of equal variances not be rejected at the 5 percent significance level. The test of the hypothesis that the two post-October 1982 periods have the same volatility as the pre-October 1979 period yielded F-statistics of 3.29 (68,104) and 3.91 (86,104), which are significant at the 5 percent level.

and the 3-month Treasury bill yield to weekly M1 announcements is estimated. An efficient markets model is used to examine the relationship between M1 announcements and changes in interest rates. This model assumes that market participants use all the information available to the public in determining interest rates. As a result, interest rates before an announcement of economic data should reflect the market's expectation concerning the announcement.

The efficient markets model yields two primary implications in this application. First, daily changes in interest rates should depend predominantly on the information market participants obtain between the closing quotations at the end of successive business days.[13] As a consequence, the closing yield of the current business day often represents the optimal forecast of the next day's closing yield. Second, any relevant information obtained between successive daily quotes should influence interest rates, but information already known by market participants should not. Moreover, any relevant information obtained from an economic release should affect interest rates immediately. Together, these considerations imply that on days of economic data announcements, including M1 announcements, daily movements in interest rates depend on the unanticipated components of the announcements plus a random error term.[14]

The first section suggested that under the federal funds rate and borrowed reserves procedures, the federal funds rate should not respond significantly to money announcement surprises. In contrast, under the nonborrowed reserves procedure, the response should be significant. For the Treasury bill yield, the response depends not only on the response of the federal funds rate, but also on the market's assessment of the Federal Reserve's desire to offset the surprise in future weeks.

A number of previous studies estimate responses of interest rates to money announcement surprises for the period before 1980. The results from these studies indicate that the federal funds rate did not respond to money announcement surprises before October 1979, but the Treasury bill yield did.[15] Moreover, responses after October 1979 during the nonborrowed reserves operating procedure were significantly greater for both interest rates.

The responses of the federal funds rate and the 3-month Treasury bill yield are estimated for the nonborrowed reserves period in the first two rows of Table 2. The specifications include a constant term and the expected value of the money announcement to examine the efficient markets model. According to this model, the constant term and the coefficient on expected money should not differ significantly from zero. The results correspond to those reported in other studies in that both the federal funds rate and the 3-month Treasury bill yield respond significantly to the unantici-

[13] If the pure expectations model of the term structure is true, movements in interest rates approximately follow a random walk if the change is measured over a short interval in comparison with the time to maturity. Because daily changes in the federal funds rate coincide with the maturity of these instruments, the random walk model may be less appropriate for this interest rate.

[14] A formal specification of this model is presented in Table 2. Survey data provided by Money Market Services, Inc., were used to form the market's expectation of M1 and other announcements. These survey data were revised using regression techniques to correct biases and incorporate movements in the Treasury bill yield from the time of the previous announcement. See V. Vance Roley, "The Response of Interest Rates to Money Announcements Under Alternative Operating Procedures and Reserve Requirement Systems," *Proceedings of the Fall 1985 Academic Conference*, Federal Reserve Bank of San Francisco, forthcoming. Raul Nicho and John Lilley supplied the survey data used in this article.

[15] See, for example, V. Vance Roley and Carl E. Walsh, "Monetary Policy Regimes, Expected Inflation, and the Response of Interest Rates to Money Announcements," *Quarterly Journal of Economics*, Supplement 1985, pp. 1011-1039.

TABLE 2
Market's response to M1 announcements

Estimation Period	Interest Rate	Constant	UM1	EM1	Summary Statistics $\bar{R}^2$	SE	DW
Jan. 1980- Oct. 1982	ΔRFF	0.0504 (0.0548)	0.1003* (0.0244)	−0.0181 (0.0315)	0.10	0.64	2.56
Jan. 1980- Oct. 1982	ΔRTB	0.0814* (0.0297)	0.0846* (0.0133)	−0.0372* (0.0171)	0.23	0.35	1.91
Oct. 1982- Feb. 1984	ΔRFF	0.0484† (0.0269)	0.0148 (0.0128)	0.0007 (0.0123)	−0.01	0.20	1.70
Oct. 1982- Feb. 1984	ΔRTB	0.0118 (0.0130)	0.0342* (0.0062)	−0.0043 (0.0059)	0.30	0.10	1.81
Feb. 1984- Sept. 1985	ΔRFF	−0.0772* (0.0284)	0.0161 (0.0170)	−0.0302* (0.0113)	0.07	0.25	1.37
Feb. 1984- Sept. 1985	ΔRTB	0.0138 (0.0111)	0.0080 (0.0066)	−0.0047 (0.0044)	0.01	0.10	2.17

*Significant at the 5 percent level.
†Significant at the 10 percent level.

Note: The precise estimation period dates are: January 1, 1980-October 5, 1982; October 6, 1982-February 1, 1984; February 2, 1984-September 26, 1985. Numbers in parentheses are standard errors of estimated coefficients. Equations are estimated in the form:

$$\Delta RFF_t \text{ or } \Delta RTB_t = b_0 + b_1 UM1_t + b_2 EM1_t + e_t$$

where b_0, b_1, and b_2 are estimated coefficients and e_t is a random error term.

ΔRFF, ΔRTB = change in the federal funds rate and the 3-month Treasury bill yield, respectively, from 3:30 p.m. on the day of the money announcement to 3:30 p.m. on the following business day (Source: Board of Governors of the Federal Reserve System, H.15)

UM1 = money announcement surprise, defined as M1 - EM1, where M1 is the announced change in the narrowly defined money stock, in billions of dollars (Source: Board of Governors of the Federal Reserve System, H.6)

EM1 = expected announced change in the narrowly defined money stock, based on the survey measure provided by Money Market Services, Inc.

$\bar{R}^2$ = multiple correlation coefficient corrected for degrees of freedom

SE = standard error

DW = Durbin-Watson statistic

pated component of the announcement. The estimated response of the Treasury bill yield indicates, for example, an average change of 0.08 percentage points, or eight basis points, in response to a $1 billion money announcement surprise. Similarly, the federal funds rate changed, on average, by ten basis points in response to the same $1 billion surprise. These results are consistent with both the implications of the nonborrowed reserves procedure and the importance of M1 targets.

The third and fourth rows of the table report estimated responses during the October 1982-February 1984 period, coinciding with the borrowed reserves procedure under LRR. The results indicate that the federal funds rate does not exhibit a response to money announcement surprises significantly different from zero, consistent with the borrowed reserves procedure. The Treasury bill yield's response is still significantly positive, but its magnitude is less than half the size of the response in the previous period.[16] Given the significance of this response, however, the market still perceived some role for M1 targets during this period.

The final two rows in the table report estimated responses for the period starting in February 1984, coinciding with the adoption of CRR. Consistent with the borrowed reserves procedure, the federal funds rate again does not exhibit a significant response to money announcement surprises. In contrast to the previous period, however, the Treasury bill yield's response also is insignificantly different from zero.[17] This result is consistent with a reduced role for M1 targets in that money announcement surprises are apparently not expected to be offset in the future. The impact of CRR on the response, however, complicates the interpretation. In particular, money announcement surprises under CRR may reflect both money demand and supply errors that partially offset each other.[18] Nevertheless, the responses of the federal funds rate and the 3-month Treasury bill yield are consistent with Federal Reserve statements about the implementation of different operating procedures and the diminished role of M1 targets.

Response of interest rates to inflation and economic activity announcements

To examine the possibility that the Federal Reserve focused more directly on inflation and economic activity since 1982 and placed less emphasis on M1, the response of the Treasury bill yield to this type of new information is examined. Only the response of the Treasury bill yield is considered because its response should be affected more than the response of the federal funds rate in the presence of a change in policy targets. The response of the federal funds rate predominantly reflects the impact of new information on the supply of and demand for reserves.

The estimates reported in Table 3 show the response of the 3-month Treasury bill yield to the unanticipated components of economic data announcements. As before, the efficient markets model is used, and the response is measured over a one-day period around the

[16] The hypothesis that the responses are the same can be rejected at the 5 percent significance level. The corresponding F-statistic is 11.84 (1,207). In this test, as well as all subsequent tests across periods, the estimated equations are weighted by their standard errors to reduce the possibility of heteroscedasticity.

[17] The hypothesis that the responses are the same can again be rejected at the 5 percent significance level. The F-statistic is 8.35 (1,150).

[18] To examine the responses over all four periods further, money surprises were separated into four groups depending on size. Large positive surprises took values of $2 billion or more, small positive surprises had values from $0 to $2 billion, and similarly for negative surprises. In the October 1982-February 1984 period, both small and large positive surprises were statistically significant at the 5 percent level. In the post-February 1984 period, however, none of the surprises were significant at even the 10 percent level.

TABLE 3
Market's response to the unanticipated component of economic data announcements*

Estimation Period	Constant	Unanticipated Change in: PPI	CPI	IP	UNEM	M1	Summary Statistics $\bar{R}^2$	SE
Jan. 1980-	0.0395†	0.0270	−0.1859	0.0850	−0.1876	0.0833†	0.16	0.31
Oct. 1982	(0.0198)	(0.0175)	(0.2069)	(0.1188)	(0.2594)	(0.0118)		
Oct. 1982-	0.0044	−0.0838	−0.2127	0.0562	−0.1734	0.0387†	0.22	0.10
Feb. 1984	(0.0091)	(0.0905)	(0.1944)	(0.0866)	(0.1567)	(0.0064)		
Feb. 1984-	−0.0018	0.0251	−0.0497	0.1497‡	0.0948	0.0087	0.00	0.10
Sept. 1985	(0.0083)	(0.0918)	(0.1964)	(0.0874)	(0.1261)	(0.0067)		

†Significant at the 5 percent level
‡Significant at the 10 percent level
*See the notes in Table 2. Equations are estimated in the form:

$$\Delta RTB_t = b_0 + b_1 UPPI_t + b_2 UCPI_t + b_3 UIP_t + b_4 UUNEM_t + b_5 UM1_t + e_t,$$

where the u's indicate that only the unanticipated components of the data announcements are included. Unanticipated values are calculated using survey data provided by Money Market Services, Inc.

ΔRTB_t = change in the 3-month Treasury bill yield from 3:30 p.m. to 3:30 p.m. on the subsequent business day

PPI = percentage change in the producer price index (Source: Bureau of Labor Statistics)

CPI = percentage change in the consumer price index (Source: Bureau of Labor Statistics)

IP = percentage change in the industrial production index (Source: Board of Governors of the Federal Reserve System)

UNEM = percentage of labor force unemployed (Source: Bureau of Labor Statistics)

particular announcement. Monthly inflation announcement surprises are measured by using the producer price index, PPI, and the consumer price index, CPI. Monthly information related to economic activity is represented by industrial production, IP, and unemployment rate, UNEM, announcements. Weekly M1 announcements also are included in the estimated models.[19]

A previous article indicated that among these sources of new information, only money announcement surprises significantly affected the Treasury bill yield in both the pre-October 1979 and the October 1979-October 1982 periods.[20] In the pre-October 1979 period, how-

[19] The estimated responses to money surprises differ slightly from those in Table 2 for two reasons. First, other announcements sometimes occurred on days of money announcements. Second, constant terms associated with the announcement surprises were assumed to be the same. The survey data used to form expectations of the announcements again were adjusted to remove biases and incorporate information about Treasury bill yield movements over the previous five business days.

[20] See V. Vance Roley and Rick Troll, "The Impact of New Economic Information on the Volatility of Short-Term Interest Rates," *Economic Review*, Federal Reserve Bank of Kansas City, February 1983, pp. 3-15.

ever, industrial production announcement surprises had some weak effects. The first row of the table reexamines the second of these periods. As before, the results indicate that only money announcement surprises significantly affect the Treasury bill yield.[21]

Estimated responses for the two periods following October 1982 are reported in the second and third rows in the table. For the October 1982-February 1984 period, the results indicate again that the Treasury bill yield does not significantly respond to any single piece of economic information other than M1 announcements. In contrast to the previous period, however, the set of economic information other than M1 announcements significantly affects the Treasury bill yield.[22] After February 1984, the effects of money announcement surprises are no longer significant, and the evidence suggests that the market may react to industrial production surprises. In particular, a one percentage point positive surprise in the growth of industrial production increases the Treasury bill yield by an average of about 15 basis points. In this case, stronger than expected real economic activity causes the market to expect future tightening of policy. The set of economic information other than M1 announcements also significantly affects the Treasury bill yield in this period.[23]

As a whole, the results in Table 3 are consistent with a reduced role for M1 after February 1984. The evidence also suggests a shift in emphasis by the Federal Reserve and market participants to direct measures of economic activity.

[21] The hypothesis that all responses other than that corresponding to M1 announcements equal zero cannot be rejected at the 5 percent significance level. The F-statistic is 1.90 (4,231).

[22] The hypothesis that all responses other than that corresponding to M1 announcements equal zero can be rejected at the 5 percent level. The F-statistic is 3.85 (4,117).

Conclusions

The behavior of interest rates since 1982 is consistent with at least two changes involving monetary policy. One relates to the adoption of a borrowed reserves operating procedure in October 1982, replacing the previous nonborrowed reserves procedure implemented in October 1979. The other change involves a deemphasis of M1 as a monetary target. The adoption of contemporaneous reserve requirements in February 1984 may have had further effects on interest rate behavior.

Three sources of empirical evidence support the notion that the market has perceived changes in policy-related factors. First, the federal funds rate became less volatile after October 1982, but the volatility remained significantly greater than before October 1979. As a result, the evidence indicates that the Federal Reserve has not reverted to the federal funds rate, or money market conditions, operating procedure of the late 1970s. Second, also consistent with the adoption of a borrowed reserves procedure, the response of the federal funds rate to new information about M1 has not been significant since October 1982. Finally, the empirical results indicate that since February 1984 the market has placed no weight on M1 announcements, as reflected by the lack of response of the 3-month Treasury bill yield. Moreover, the market's response to new information about economic activity has been somewhat enhanced since October 1982. These results are consistent with a reduced role for M1 in conducting monetary policy and also consistent with Federal Reserve statements about its operating procedures.

[23] The hypothesis that all responses other than that corresponding to M1 announcements equal zero can again be rejected at the 5 percent level. The F-statistic is 3.77 (4,128).

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