Economic Review

FEDERAL RESERVE BANK OF KANSAS CITY

January 1984

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LDC Debt and the Dollar

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of Tenth District States

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Rate Changes on Market Interest Rates

The *Economic Review* (ISSN 0161-2387) is published ten times a year by the Federal Reserve Bank of Kansas City. Subscriptions and additional copies are available without charge. Send requests to the Research Division, Federal Reserve Bank of Kansas City, 925 Grand Avenue, Kansas City, Missouri 64198. If any material is reproduced from this publication, please credit the source. Second-class postage paid at Kansas City, Missouri. Postmaster: send address changes to the address above.

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The debts of less-developed countries threaten the stability of world markets. This threat will continue until the outlook for noninflationary economic growth improves worldwide. A change in the U.S. policy mix would improve the economic outlook.

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Economic recovery will ease many of the budget problems that have plagued the seven states of the Tenth Federal Reserve District. Some of the problems will remain, however, requiring a careful rethinking of budget plans.

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Prospects for LDC Debt and the Dollar

By Scott E. Pardee

The debt problems of the less-developed countries (LDC's) will remain one of the most serious challenges of our decade. Many of these countries are already in a condition which five years ago we would have called default or bankruptcy. They simply have not been able to pay their debts or, in some cases, to meet their interest payments. To the markets, the prevailing view had always been that if one or more countries were unable to pay their debts a crisis would erupt.

The experience of the past year shows that such a crisis can be headed off by hard work and skillful negotiations by people in the commercial banks, the central banks, the Bank for International Settlements (BIS), the International Monetary Fund (IMF), and the governments that are most directly involved.

The flash point has shifted from purely financial considerations, which influence the ability to pay, to the political considerations, which might affect the willingness to pay. The fear in the markets now is that one or more countries will be forced by events to flatly repudiate their debts. Such an action is likely to be in a political context in which hard work and skillful negotiations by experts in international finance just won't matter.

There has already been considerable progress. Mexico has turned itself around, albeit with Draconian domestic measures that cannot be sustained for very long. Brazil has completed its negotiations with the banks and the IMF and has implemented a program which should bring about a significant international adjustment. Argentina has recently inaugurated a new democratically elected government, which is likely to improve substantially upon the chaotic economic policies of the latest military government. The Philippines loans are still a problem, but the problem revolves more around the question of who will be the successor to President Marcos than around the question of that country's ability and willingness to service its debt. In all, 33 countries have gone to the IMF, are submitting themselves to the Fund's economic discipline in the form of new adjustment policies, and are receiving some money from the Fund. Of these, 14 countries have completed debt

Scott E. Pardee, executive vice president of Discount Corporation of New York, was formerly manager of foreign operations for the Federal Reserve Open Market Account in New York. The views in this article were presented to the board of directors of the Federal Reserve Bank of Kansas City on December 15, 1983. The opinions expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Kansas City or the Board of Governors of the Federal Reserve System.

rescheduling agreements with the banks.

The U.S. Congress has passed the bill to increase the U.S. contribution to the IMF, and Fund staffers are relieved that the resources they were promised by the member governments will now be forthcoming. A backstopping arrangement among central banks in the BIS has also been recently completed. But serious problems remain, and we are entering a prolonged, and perhaps the most dangerous, phase of the debt crisis. It will not be an easy workout.

Deputy Secretary of the Treasury Tim McNamar recently outlined the administration's strategy for dealing with the next phase of the international debt problem. The strategy has five elements:

1. Industrialized governments should adopt policies to sustain non-inflationary growth.

2. LDC's should follow sound economic policies and live within their means.

3. The IMF should be further strengthened.

4. Continued commercial bank lending must be encouraged.

5. And bridge financing should be kept available.

Each of these is a noteworthy objective, but all are difficult. Starting with the first point, I agree that the need for solid non-inflationary growth in industrialized countries is paramount. If we don't buy goods from LDC's, they can't earn enough to service their debt. If we allow U.S. inflation to revive, that might temporarily help the LDC's in terms of better prices for their products. But many of these countries are just beginning to grapple with their own very high rates of inflation, and more rapid inflation in this country could undermine their efforts to achieve greater price stability.

I see two serious roadblocks. First, although the United States is currently in a vigorous economic expansion, and western Europe and Japan are also doing somewhat better, the chances for sustained non-inflationary growth are clouded by the current U.S. policy mix.

The huge budget deficits, coupled with tight monetary policy, have led to punishingly high interest rates. In the United States, most consumers and businessmen have learned how to live with high interest rates, even in real terms, because interest costs are tax deductible. Tax systems in other countries are not so generous, and certainly a foreign government borrowing money in U.S. dollars gains no benefit whatsoever. So the LDC's argue that in addition to all the sound domestic reasons we have to reduce the deficit and allow interest rates to come down, there is also a foreign reason: lower U.S. interest rates would provide for a greater sustainability of growth in the industrial countries and would reduce the already staggering direct interest rate burden on the LDC's.

From my perspective, I see no significant actions by the administration or Congress to resolve the budget deficit before next year's election. Even in 1985, considerable time may elapse before budget cutting measures can be proposed, debated, and passed. We might not have a sound fiscal policy in this country until 1986 — nearly three years from now — at the earliest.

The second roadblock to promoting non-inflationary growth is the tendency toward increased protectionism. The LDC's cannot increase their exports in industrial countries if we won't let their goods in. The LDC's are selling their primary products at historically

reduced prices in an effort to earn dollars to service debt and pay for needed imports. But some of these items are also produced in the industrial countries, and the depressed prices from abroad have led domestic producers to ask their governments for protection or added subsidies. The LDC's are also hoping to increase their exports of manufactured and semi-manufactured goods. Here, too, they are running into increased barriers.

For all the talk about the need for trade liberalization, whether on a north-south basis or even among developed countries, there seems to be little effort to do anything right now. The latest ministerial meeting of the General Agreement on Tariffs and Trade (GATT) was a shambles. As barriers continue to be erected, the LDC's will increasingly find themselves odd man out.

Turning to the second leg of the Treasury's strategy, the need for the LDC's to follow sound economic policies and to live within their means, problems abound here as well. The very reason some of these countries are in a bind is that for years they have not followed sound policies or lived within their means. It is unrealistic to expect those countries to change overnight. And even for countries that are following more reasonable policies, huge sacrifices will have to be made, not just for one year but over a series of years, to restore their international credit worthiness.

To develop a credible policy, the LDC governments must gain and maintain the support of both rich and poor alike. The wealthy have established channels for moving capital abroad or accumulating it abroad rather than investing it at home. And capital flight occurs whenever these people become concerned. If Mexico could persuade its own people to bring home the money they have placed abroad in recent years, Mexico would not need to borrow another cent from the U.S. banks or the IMF. The same is true of many other countries.

The poor can always rise up, whether in food riots, peasant rebellions, general strikes, or outright guerilla warfare. We read regularly of the tensions which are building up in one or another debt-ridden LDC, and we know of the hostilities that have already broken out in some areas. Additional economic restraints are difficult to impose on these populations, even if in the interest of greater stability over the long run. Many governments do not have much time for austerity programs to work their way through the economy. IMF programs are usually set up for three years, but the ability to carry out these programs in some countries may be measurable only in months. The Soviet Union and Fidel Castro, for example, have a great deal to gain if the governments run out of time. For the U.S., the stakes are particularly big in Mexico. Any sort of political or social upheaval there could send millions of people across our border looking for safety and jobs. Again, Mexico, is not the only source of potential substantial emigration to the U.S. For this reason alone, the LDC debt problem has to retain a high policy priority in the United States, even though many of the tough negotiations are behind us.

The Treasury's third point of strategy is the strengthening of the IMF and other international financial institutions. The IMF has done a superb job, and I believe that the U.S. officials directly involved with the IMF, including Richard Erb, its executive director, should be commended for the skillful work they have done during these long months of exacting case-by-case negotiations. Federal Reserve staffers also deserve great credit. These negotiations were within the present framework.

Many worthwhile proposals have been made for improving the IMF as well as the World Bank and its affiliates. The problem now is not the lack of ideas but the political willing-

ness of the United States to resume its role as leader in developing these ideas and implementing them. Earlier, the administration devoted a great deal of energy to the question of whether or not to revert to a gold standard, and so far has not made many initiatives in international finance. Moreover, I believe the administration mishandled its relations with Congress on the IMF quota increase bill, since the bill became hostage to domestic pork-barrel politics. Congress responds to leadership. In dealing with other countries, particularly our allies in western Europe and Japan, U.S. negotiators have worn thin the argument that they cannot join in one or another cooperative effort on the international level in which increased financing may be needed because Congress will not agree to it.

The financial authorities of other countries have similar problems at home and manage to overcome them. Unfortunately, I do not see the administration changing its approach. While we can hope that the IMF and other international financial institutions continue to do a good job, they are not likely to be given a substantially greater mandate, power, or resources to work with for the foreseeable future.

Turning to Deputy Secretary McNamar's fourth point — the encouragement of continued commercial bank lending — here, too, the picture is pretty grim. The internationally active banks, and the large U.S. banks, in particular, need to rebuild their own capital base and credibility. The public knows that banks have a lot of stale loans on their books which will take years to clean up. Investors in bank shares are skeptical about the write-off procedures, wondering if the loan losses have not been seriously understated in quarterly earnings figures. Investors in CD's and other bank paper also raise questions at every turn.

In my company, we have seen how quickly so-called flights to quality develop though shifts into Treasury bills from CD's. Investors are quick to sell out or run paper off at maturity whenever they hear of a new LDC problem. The banks are taking huge spreads now, improving their earnings, although it is not easy conceptually to measure what they are doing since the new loans are being made to allow borrowers to pay interest on old loans. The current comment on this topic is "a rolling loan gathers no loss." For those banks whose exposures are under reasonable control, some very good deals are opening up, as in Mexico. But top management and banks' boards of directors may not resume significant voluntary lending to the LDC's for some time. This is especially true for regional banks.

The Treasury's fifth point of strategy is to maintain the willingness and capability to provide bridge financing where necessary. My impression is that the recent experiences were so unpleasant for those involved, particularly in the BIS facilities, that less financing is probably available now than before. Bridge loans need to be for short terms against strong collateral with a secure takeout on the other side. These conditions did not hold in some of the bridge loans which were made and are even less likely to hold now.

To conclude this discussion of the LDC debt situation, the U.S. Treasury has set forth a useful structure for analyzing the problem but still lacks a comprehensive strategy for solving it. And yet, from the market's point of view, a proliferation of LDC debt repudiations, leading to a collapse of the international financial system, ranks second only to all out nuclear warfare as the most frightening international development we can imagine.

In the late 1970s, when the dollar was declining day-by-day in the exchange market and we at the desk at the New York Fed could do little to stop it, we cheered ourselves up by

saying "Buy dollars and wear diamonds." We even had some T-shirts made up with that slogan. The dollar has now been strong for two years, and it is the people in the market who are using the phrase, rather than those at the Fed. Anyone who has sold dollars has risked losing his shirt. Buyers of dollars may not have made much, because the markets have been very volatile, but at least they have had a chance.

If the market were to trade on the basis of fundamentals, the dollar would not be at the lofty levels it is. The U.S. has developed a substantial trade deficit — forecasters are pointing to a deficit in excess of $100 billion next year. Our inflation rate is much better than it was, but the Germans and Japanese are still beating us. The mismanagement of our economy — in terms of our fiscal policy — is unmatched by any of our trading partners. Today, I could give good solid reasons for selling dollars, and some of the factors involved are getting worse rather than better.

But the dollar is strong, and some traders are telling their clients they "would not be surprised if" the dollar were to move from the current levels of DM 2.75 or so to the dollar to DM 2.85 or even DM 3.00 to the dollar next year. Sterling has taken a drubbing recently on concern over the oil price, dropping to $1.42 per pound, and some traders are talking $1.25 per pound. These traders really will be surprised if these predictions come true, in my judgment, but if so they will "wear diamonds" because they are now long in dollars and are "talking their book."

The strength of the dollar, of course, stems from capital inflows. In my own company we see some of the huge foreign private demand for U.S. government securities. Foreign money has also come into our stock market, particularly since it began rallying in the summer of 1982. When I travel abroad, someone always asks me how he can find someone honest who can help him buy real estate in the U.S. One of the reasons for the inflows, of course, is that our interest rates are much higher than in many other countries. Another reason is a political perception that the U.S. is the last bastion of capitalism in a world going socialist, a phrase I hear often.

The last point may be debatable, but I have learned not to argue politics with a customer.

These are all reasons to buy dollars. People also cite factors which prompt them to sell other currencies to get into dollars. The list of reasons for not investing in western Europe is a long one. It includes the sluggishness of the economies, the ineffectiveness of economic policies, the stultifying effect of European bureaucracies on private enterprise, and the fear of a spread of Finlandization — governments which kowtow to the Soviet Union. And the nuclear debate has been particularly scary. "The Day After" has been showing in packed theaters throughout western Europe these past few weeks, with a particularly strong effect in West Germany.

Some of the capital inflow is not entirely rational. People buy dollars when they worry that Brazil may default, even though U.S. banks have by far the biggest exposure. People buy dollars when there is another dangerous confrontation in Lebanon, even though U.S. troops have been killed in so many of these incidents. And people buy dollars when the Russians engage in saber-rattling. Such events which prompt dollar buying now would have triggered selling waves in the late 1970s. The administration claims that this is because our strategic posture is more credible now. I am not so sure. It seems to me that people are frightened and believe they have no place else to go but to dollars. Gold, silver, and Swiss francs have lost their luster to hot money investors.

The dynamics of the exchange market have added to the dollar's strength. To the extent traders have made good money, it has been on long positions in dollars. And those who would seek to manipulate the market — including now the London banking arm of the Soviet Union — have found that the market will move quickest if they jump in as a big buyer of dollars. The dollar is already overvalued against several major currencies, and a further rise would compound the existing misalignment.

Most market participants believe that at some point the dollar will turn. It has been pushed up by a wide range of uncertainties and shocks. If there are two or three weeks of peace and quiet or there is a sustained decline in U.S. interest rates, money would stop flowing into the U.S. Once the inflows stop, or even slow down, the dollar will begin to decline. If capital outflows then develop, the decline will accelerate. Foreign central banks would not do very much to resist the decline of the dollar, as through intervention. So the dollar, having seriously overshot in the upward direction, could conceivably overshoot in the other direction.

I doubt that a devastating plunge of the dollar is likely, however. Foreign central banks are under pressure to reduce their own interest rates and would take advantage of a cheaper dollar to do so. Also, the Federal Reserve has a different kind of monetary policy than it had during most of the 1970s. Then, interest rates were negative in real terms; now they are positive. There is no longer the clear incentive to borrow dollars and short the dollar in the exchange market on the expectation of repayment with cheaper dollars.

As you know, I am concerned about the U.S. Treasury's current policy of non-intervention in the exchange market. The dollar is the world's leading currency. The U.S. should play a leadership role in assuring the world that exchange rates are reasonably well aligned and that exchange markets are reasonably orderly. U.S. leadership in the past was fitful, to be sure, as Administrations changed and Treasury officials came and went, but the need for close coordination was always understood. The Federal Reserve has a big stake in the foreign exchange markets which, after all, are money markets once removed. The Fed also has a big stake in maintaining the close working relationships which have been built up over the years with counterparts in foreign central banks.

But the Treasury has brought all of that to a halt by fiat. What little intervention we have seen recently has been haphazard, too small to be effective, and clearly motivated by politics. My hope is that we can restore in this country some sense of balance in international monetary affairs. The Treasury should concern itself about the big picture and about relations with Congress, and leave the Federal Reserve to conduct the day-to-day operations in the market and with foreign central banks in its usual, thoroughly professional manner.

Fiscal Condition of Tenth District States

by Mark Drabenstott, Marvin Duncan, and Anne O'Mara McDonley

State governments have come under increasing budget pressures in recent years. Many of the problems can be attributed to the economic recession and its effect on revenue and expenditures. Other factors, such as cutbacks in federal grants-in-aid, the high cost of issuing bonds, changing demographics, and voter resistance to tax increases also have contributed to a deterioration in state budgets.

States of the Tenth Federal Reserve District — Colorado, Kansas, Missouri, Nebraska, New Mexico, Oklahoma, and Wyoming — have had additional problems. While energy and agriculture had been countercyclical sources of strength to the district economy in the past, both of these important sectors have suffered a recession along with the rest of the economy since 1981. As a result, revenue pressures have increased in these seven states.

This article reviews the fiscal status of Tenth District states from 1973 through 1982 and discusses both changes in state finances and probable reasons for the changes. The first section discusses differences in the state and federal budget processes. The second section examines the growth of revenue and expenditures in district states and discusses some recent factors shaping the state budget environment. The third section analyzes the budget pressures that have resulted from the economic recession. The fourth section considers some of the challenges district states may have to face in effectively managing their budgets in the future.

Mark Drabenstott is a senior economist, Marvin Duncan is a vice president and economist, and Anne O'Mara McDonley is an assistant economist, all with the Economic Research Department of the Federal Reserve Bank of Kansas City.

State and federal budget systems

There are substantial differences between the states and the federal government in budget-making procedures and fiscal policies. Moreover, state procedures and policies sometimes contribute to the fiscal problems they are now experiencing. This section reviews these differences, compares the way states and the federal government incur debt, and summarizes the growth in state and federal debt.

The use by state governments of separate capital budgets is one marked difference from the federal government's budget process. The federal government's budget accounting makes no distinction between payments based on the useful life of purchases or transfer payments. All budget items are fully expensed in the year purchased. When the federal govern-

TABLE 1
State limitations on deficits in general operating budgets

	Number of States with Limitations that are:		
United States			
Type of provision	Prohibitive	Constraining only	Total
Constitutional	33	6	40
Statutory	6	2	8
None	-	-	2
Total	39	8	50
Tenth District			
Type of provision	Prohibitive	Constraining only	Total
Constitutional	5	1	6
Statutory	1	0	1
Total	6	1	7

Note: Ten states cited both constitutional and statutory provisions.
Source: The National Association of State Budget Officers, *Limitations on State Deficits*, The Council of State Governments, Lexington, Kentucky, April 1976. This publication has not been updated, but a phone survey validated the table above.

ment buys a dam, a highway, or a jet aircraft, the accounting system handles that expenditure the same way it handles purchases of office supplies — as though the useful life of the goods or services purchased did not extend past the fiscal year they were bought. States, however, typically separate their capital-improvement and operating budgets, thus taking into account differences in the useful life of purchases.

That difference explains why states ordinarily are perceived to balance their budgets every year. Actually, what states balance is their general operating budgets. All but two of the 50 states — Vermont and Connecticut — have constitutional or statutory limits on their ability to run deficits in their general operating budgets (Table 1).

States do incur debt, however, to make capital investments. Investments such as roads, buildings, waterways, and dams often are funded with borrowed capital repaid over the expected useful life of the asset — a practice not much different from that in the private sector. Most states finance these big-ticket items through capital market bond issues or, in the case of highways and other transportation-related investments, by transfer payments from the federal government. Funds to repay bonded indebtedness are generated by special tax levies, usually voted in by the taxpayers, and by receipts from special federal and state taxes or trust funds, such as federal and state gasoline taxes.

An important distinction between federal and state capital spending programs is that the states, unlike the federal government, establish the sources of repayment funds before the capital expenditures are made.

Although Congress sets federal debt ceilings, three general constitutional and statutory restraints limit the ability of states to incur debt. One restricts the total debt level. Outstanding debt may be limited, for example, to

a percentage of the assessed property value in the state. Another requires that general operating budgets be in balance. The third outlines procedures for managing budget deficits, whether impending or incurred. Procedures may require, for example, that state expenditures be cut or taxes be raised enough to cover the previous year's deficit.

States, therefore, operate under much tighter budget restraints than the federal government. Decisions to incur debt in state government typically require direct legislative action or a vote of the people.

States, nevertheless, have incurred substantial debt. Demands for infrastructure have grown along with population and industry, and the rapid inflation of the past decade added substantially to the cost of such projects. So, despite legal restraints on the ability of state governments to incur debt and despite the reluctance of taxpayers to vote for higher taxes, state government debt has increased markedly in the past decade (Chart 1). Between 1973 and 1982, debt for all 50 states increased 259 percent, compared to a 245 percent increase in federal debt. Since 1980, however, growth in federal debt has outstripped that of the states. Debt outstanding for Tenth District states grew more rapidly than for the 50 states, increasing 374 percent between 1973 and 1982.

The state budget environment: 1973-82

Changes over the past ten years have put increasing stress on the budgets of Tenth District states. After more than a decade of strong economic growth before 1973, the states entered the 1973-82 period with healthy fiscal surpluses, low unemployment rates, and moderate growth in expenditures. With rapid inflation and energy price shocks beginning about 1973, all that changed.

Changing revenue and expenditure patterns

General revenue for district states grew strongly over the 1973-82 period, reflecting fairly rapid economic growth. General revenue increased more than 10 percent a year in every year except 1974 (Chart 2). For the period as a whole, revenue increased at an average annual rate of 11.7 percent. By 1982, general revenue for the seven state governments totaled more than $19.5 billion.

District state revenue generally grew more rapidly than for the nation as a whole. Revenues for all 50 states increased at an average annual rate of 10.4 percent, 1.3 percentage points less than for the district states (Table 2). Of the district states, energy-producing Wyoming, New Mexico, and Oklahoma had the fastest growth in revenues.

At the same time that total revenue grew, the composition of revenue sources changed. More than 86 percent of district states' general revenue in 1973 came from intergovernmental transfers — overwhelmingly federal grants-in-aid — and from sales taxes and from individual and corporate income taxes. Charges for state services and income from other sources accounted for only slightly more than 13 percent of all revenues. By 1982, federal budget austerity, recession, and taxpayer revolt had trimmed the share of revenue provided by transfers and taxes to less than 80 percent, leaving states to rely more heavily on other revenue sources (Chart 3). Miscellaneous revenues from such sources as interest earnings, rents, and sale of properties grew 38 percent a year after 1978.

For most of the 1973-82 period, spending in district states increased faster than revenues. For the entire period, expenditures grew an average of 11.7 percent a year, the same rate as for revenue. Until 1982, however, growth

CHART 1
Total long-term debt

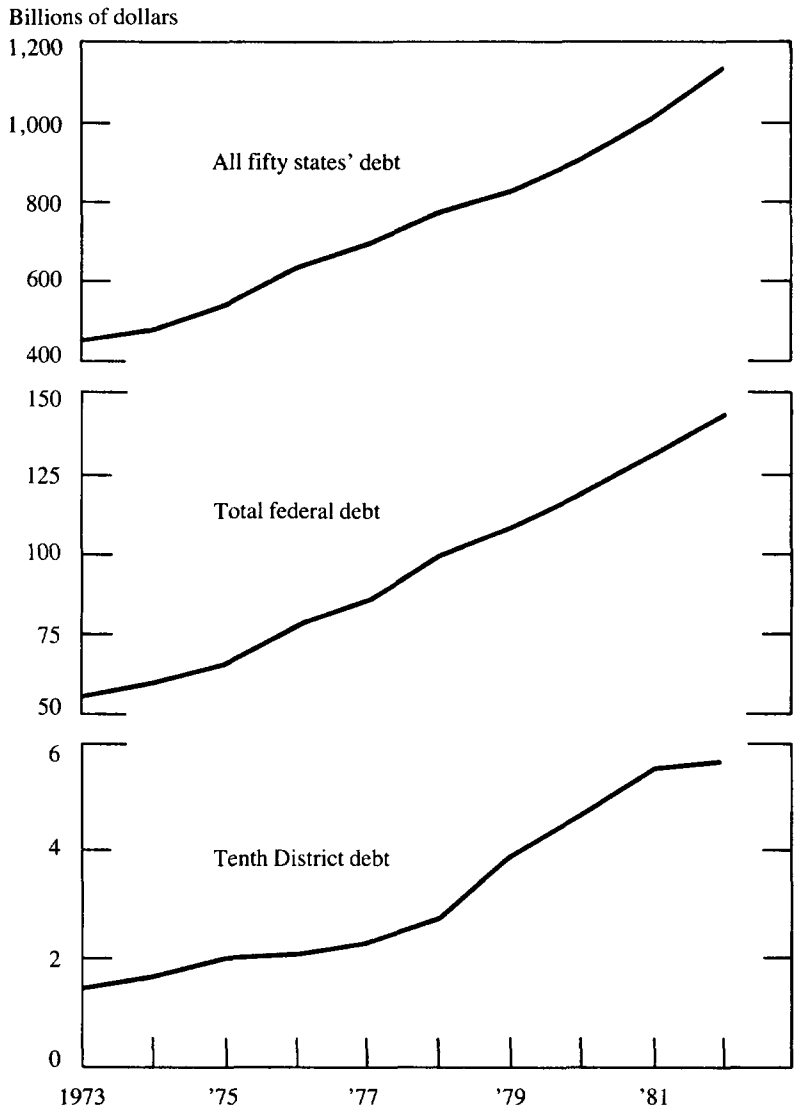


CHART 2
Growth in general revenue and expenditures
Tenth District states

in expenditures outstripped growth in revenues by a significant margin (Chart 2). Expenditure growth slowed dramatically in 1982 as states responded to increased fiscal strain in 1980 and 1981. The rapid growth in expenditures before 1982 reflected growing demand for state public services resulting from increases in population and economic activity. Recent cutbacks in federal social programs also caused states to spend more for some affected programs. Spending by district states also increased faster than the average for all states

TABLE 2
Growth in general revenue
(percent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1974-82 Average
Colorado	12.8	13.9	13.3	7.0	11.9	14.0	9.3	4.0	9.3	10.6
Kansas	7.9	12.2	14.1	9.9	7.9	13.3	10.2	9.8	2.3	9.7
Missouri	7.2	6.6	11.6	9.3	11.8	11.9	11.5	3.4	5.5	8.8
Nebraska	9.4	9.6	17.8	12.1	11.8	8.3	12.3	4.9	4.9	10.1
New Mexico	11.0	20.9	11.3	8.6	22.1	13.1	18.2	24.8	12.0	15.8
Oklahoma	8.6	11.8	12.5	13.2	12.3	12.9	17.2	19.2	13.4	13.5
Wyoming	9.0	26.1	27.4	13.9	17.9	16.4	19.6	26.0	35.2	21.3
Tenth District	9.2	12.1	13.6	10.0	12.8	12.7	13.3	11.4	10.0	11.7
50 States	8.1	10.0	13.0	11.7	11.3	10.0	12.3	10.5	6.6	10.4

Source: State Government Finances, U.S. Bureau of the Census.

during the decade. State expenditures in the nation increased an average of 10.8 percent a year, 1 percentage point less than the average increase for district states (Table 3).

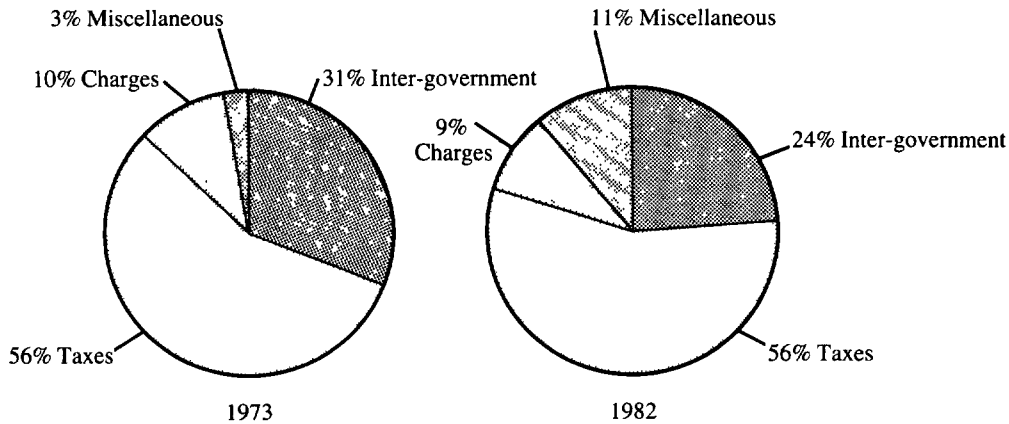
The overall mix of expenditures in district states remained fairly stable throughout the period. Education was the biggest expense, accounting for more than 40 percent of total spending every year (Chart 4). Public welfare assistance and transportation, mostly highway construction and maintenance, were other major expense items. Together, education, public welfare, and transportation accounted for nearly three-fourths of total general expenditures. In dollar terms, all three functions grew significantly from 1973 to 1982. But spending on health programs and hospitals grew faster than any other type of state spending. Reflecting the rapid increase in health care-costs and the strong demand for public health programs, health expenditures increased nearly 15 percent a year.

Fiscal surplus and deficit

The fiscal status of district states has deteriorated since 1973. With expenditures increasing faster than revenues in most years, most district states have come under growing budget stress. Some states even faced budget deficits in 1981 and 1982.

Fiscal surplus may be defined as the difference between general revenue and general expenditures in a given year. General expenditures include both operating budget items and amortized capital investment expenditures. As a deficit indicates that a state's general revenues cannot cover its general expenditures, this negative balance must be offset by expenditure cuts, tax increases, or a carryover surplus from previous years. States can reduce the strain on general revenue by issuing bonds to cover specific capital expenditures, thus removing such amortized items from the general budget. The surplus or deficit in any particular year, therefore, reflects the extent of strain on a budget resulting from the balance of general revenue and expenditure. The particular budget balance discussed here does not take into account carryover surpluses from previous years or subsequent actions to offset deficits. And, because of restraints on their

CHART 3
General revenue by sources
Tenth District states



Source: State Government Finances, Bureau of the Census

ability to run operating budget deficits, states almost certainly used carryover surpluses, raised taxes, or reduced expenditures to offset their deficits.

Taken together, district states maintained a budget surplus for the entire 1973-82 period (Chart 5). Except for 1982, the surplus declined during the two recession periods, 1974-75 and 1980-81, and increased during business expansions. In 1982, the surplus actually increased as district states cut back sharply on expenditures while recession further slowed revenue growth. The fiscal surplus for district states did not erode as sharply during either recession as the surplus of all states. The relatively resilient district economy provided stronger growth in state revenue during economic downturns than for the nation as a whole (Chart 5). The district's healthy positive fiscal balance in 1981 and 1982 masks some sharp distinctions among states, however. In 1981, for example, Colorado, Kansas, Missouri, and Nebraska all had budget deficits. For the district as a whole, these deficits were more than offset by large surpluses in Oklahoma, New Mexico, and, to less extent, Wyoming (Table 4).

Recent factors affecting state budgets

Several factors other than general economic activity are now shaping the budgets of district states. These factors include greater austerity in federal grants to states, the high cost of issuing debt, and changes in demographics.

Growth in federal transfers to district states has slowed sharply in the past two years. Before 1973, district states came to rely on federal dollars to make up about 30 percent of their total revenue. Between 1973 and 1980, total annual grants to district states about doubled, exceeding $4.3 billion in 1980. Since then, however, cutbacks in federal spending have slowed the increase in grants to states to

TABLE 3
Growth in general expenditures
(percent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1974-82 Average
Colorado	13.8	21.7	12.0	8.2	6.6	11.1	11.2	15.5	7.9	12.0
Kansas	11.7	17.1	17.3	10.4	2.5	16.5	10.7	13.0	1.1	11.1
Missouri	10.7	15.7	8.1	2.8	11.3	12.4	17.2	10.8	(1.0)	9.8
Nebraska	13.2	21.5	10.4	10.5	10.6	10.0	10.3	11.5	5.5	11.5
New Mexico	10.8	13.4	15.5	7.2	18.4	20.0	10.2	16.4	17.4	14.4
Oklahoma	4.3	9.1	15.0	11.2	7.6	15.1	17.8	15.8	11.3	11.9
Wyoming	4.6	22.3	38.0	(3.0)	13.3	24.5	26.8	20.2	15.8	18.1
Tenth District	10.1	16.2	13.4	7.4	9.1	14.4	14.3	14.0	6.8	11.7
50 States	10.9	15.4	11.1	8.0	8.8	11.5	13.8	11.1	6.2	10.8

Source: State Government Finances, U.S. Bureau of the Census.

1.9 percent a year, compared with 12 percent from 1973 to 1980 (Chart 6). As a result, federal transfers amounted to 24 percent of total district revenue in 1982.

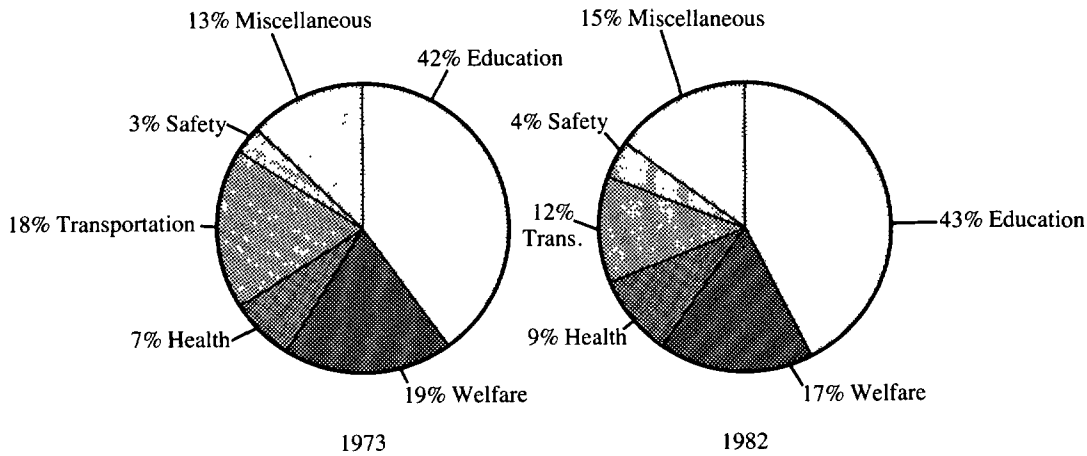
The recent slow growth in federal transfers has left district states with the need to provide for more revenue. That has proven particularly difficult during a recession and at a time when demands on states were increasing rapidly. Consequently, the cutbacks have forced states to raise taxes or fund more capital expenses by issuing debt. Because the prospect of large federal deficits is likely to limit increases in federal transfers, district states may have to adjust to a permanently lower growth rate in federal revenue support.

District states have responded to growing budget pressures by funding more capital expenditures through debt issuance rather than increases in general revenues. Between 1973 and 1982, total long-term debt more than tripled — an average annual growth rate of more than 16 percent. Debt issuance peaked in 1979, when district states placed more than $1 billion in bonds. Although debt is one way of funding some capital expenditures, high interest rates on new bonds have tended to discourage states from undertaking even more debt. Municipal bond rates, after remaining fairly stable at 5-6 percent until 1979, increased sharply thereafter and averaged almost 11 percent in 1982. With interest rates about twice what they had been in the 1970s, district states found bond issues for capital outlays increasingly costly at the very time their fiscal positions were deteriorating, and in some states were becoming deficits.

Although municipal bond rates are now below their 1982 peaks, large federal budget deficits have kept market rates well above the levels enjoyed throughout much of the 1970s. The cost of new debt, therefore, is continuing to complicate the funding decisions of district states.

In addition to slowing federal aid and higher interest rates, population growth also significantly affected state budgets during the 1973-82 period. The population of district states has increased an average of 1.4 percent a year since 1973. According to preliminary data, the district's population totaled 17.0 million at mid-1982, compared with 15.2 million in 1973. Rates of growth varied from state to state. The fastest growth was in Colorado and

CHART 4
General expenditures by function
Tenth District states



Source: State Government Finances, Bureau of the Census

Wyoming. Missouri, Nebraska, and Kansas had very low rates of growth, with population declines some years. States with rapidly increasing populations generally had significant increases in expenditures, but they also had a growing revenue base. States with little change in population saw a slight slowing in the expenditure growth but a noticeable decline in their revenue base.

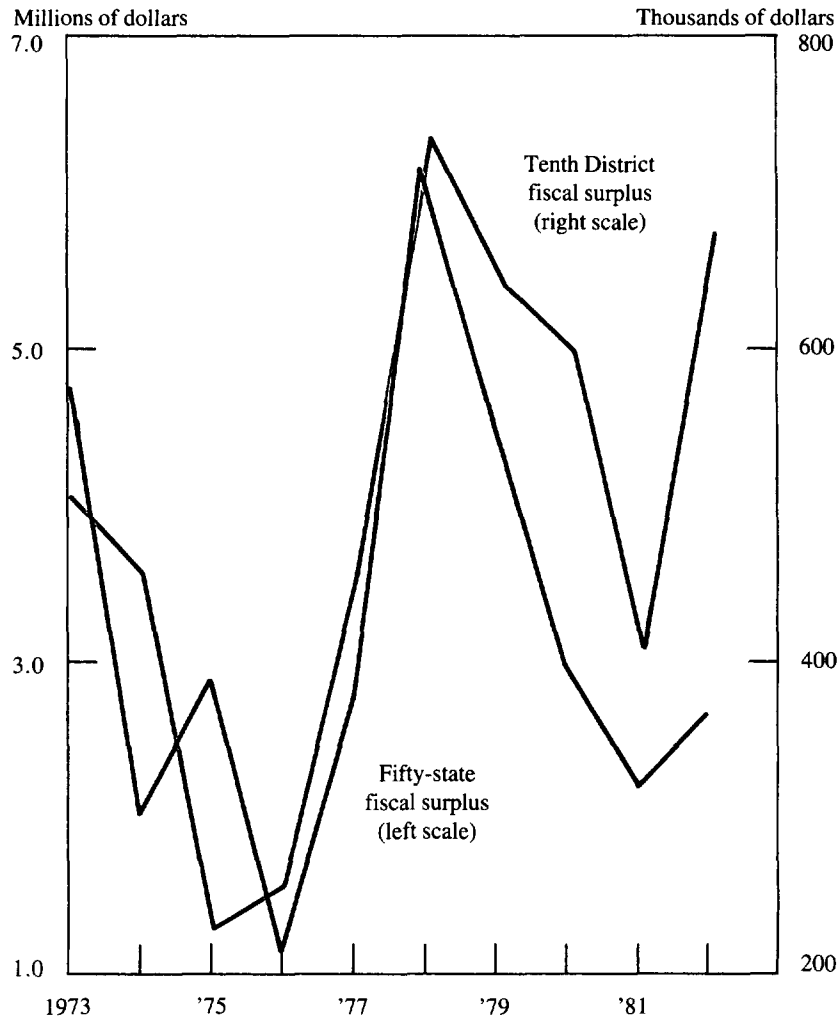
Changes in the age distribution in district states also affected state budgets. Two population trends were evident over the past ten years. First, the postwar baby-boom generation matured into its early working years: The proportion of district population between the ages of 17 and 44 increased from 36.7 percent in 1973 to 42.2 percent in 1982. This change provided a growing base for state tax revenues (Chart 7). Second, the proportion of elderly people increased, though only slowly, from 11.1 percent in 1973 to 11.8 percent in 1982. Although the shift was less pronounced than in other parts of the country, an increase in the proportion of elderly people creates budget pressures for states. People in this age group usually are retired and receive more state-funded services than they pay in taxes or other revenue. Thus, with the aging of the population, states have felt additional budget pressures.

In brief, district state budgets have come under increasing pressure as expenditures usually have grown faster than revenue. Meanwhile, the budget-making environment also has changed. Slowing growth in federal grants, high rates on municipal bonds, and changing demographics have all made balancing state budgets more difficult than a few years ago.

Budget performance in recession

While several factors have influenced state budgets over the past ten years, economic

CHART 5
Tenth District fiscal surplus
(1972 dollars)



recession has been the dominant one. The two most severe recessions in the postwar period came during the past ten years,in 1974-75 and 1981-82. This section analyzes the effects of these recessions on state budgets.

The latest recession cut deep into the revenue of district states. The growth in personal income over the district slowed to only slightly more than 6 percent in 1982, compared with annual gains averaging more than 11.7 percent from 1973 to 1980 (Chart 8). Growth in personal income for the nation

TABLE 4
State fiscal surplus (deficit)
(millions of dollars)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Colorado	118	121	34	60	42	153	234	211	(77)	(42)
Kansas	117	91	50	18	13	100	61	58	(3)	25
Missouri	156	106	(61)	9	166	198	207	53	(212)	37
Nebraska	64	47	(28)	28	46	63	49	79	(6)	(15)
New Mexico	67	75	147	129	153	226	169	321	541	501
Oklahoma	15	74	121	97	144	254	240	267	416	541
Wyoming	10	21	36	14	86	120	103	82	145	364
Tenth District	546	537	300	354	650	1,114	1,063	1,072	803	1,410
50 States	5,038	2,436	(3,693)	(1,572)	3,871	9,297	7,524	5,369	4,505	6,146

Source: State Government Finances, U.S. Bureau of the Census.

slowed from 11.1 percent to 6 percent. The slowdown in the region's economy translated into slow growth in general revenues in 1981 and 1982 (Chart 2).

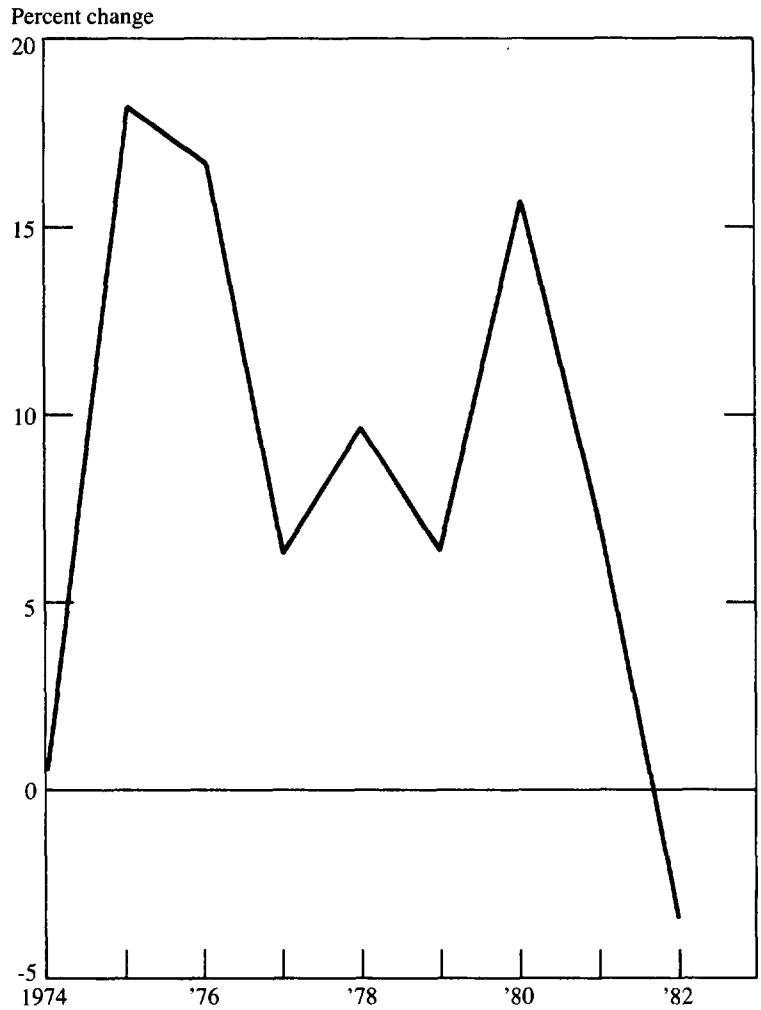
The effect of the recession on general revenues was especially severe because of coincident weakness in nearly all sectors of the region's economy. Countercyclical strength in agriculture and energy served in previous recessions to help offset declines in manufacturing and retailing. But from 1980 through 1982, agriculture and energy were undergoing recession along with other sectors of the district's economy. Numerous problems — weak export markets, abundant grain supplies, and a weak national economy — have kept agriculture in recession since 1979. Energy production, accounting for 5.7 percent of district income in 1982, has fallen sharply because of declining energy prices and weak demand in world markets. With the effects of the recession broadly felt in all district states, growth in state revenue slowed.

The recent recession also affected state budgets by creating more need for public assistance programs. Rising unemployment, combined with weakened incomes, caused many public assistance programs to swell. Unemployment rates increased sharply over the district during the past two years. After a decade of fairly stable unemployment rates of between 4.0 and 5.5 percent, the district unemployment rate climbed to 7.5 percent in 1982. Only in 1975 had the district's unemployment rate risen above 6 percent. As unemployment increased, expenditures for public welfare programs expanded 19 percent in 1981, and then rose 6.6 percent in 1982 as states cut back because of fiscal strain.

The dual effects of recession — reduced revenue and increased expenditures — created budget pressures that many district states had not known before. Only two states, Missouri and Nebraska, had deficits in the 1974-75 recession, and they came only in 1975. In 1981, these states along with Colorado and Kansas had deficits. In 1982, sharp expenditure cutbacks left deficits in only two states, Colorado and Nebraska. Thus, while both recessions had noticeable effects on state budgets, the recent downturn left a more lasting imprint on budget positions in the district.

Several measures suggest that the recent recession had a more severe effect on state

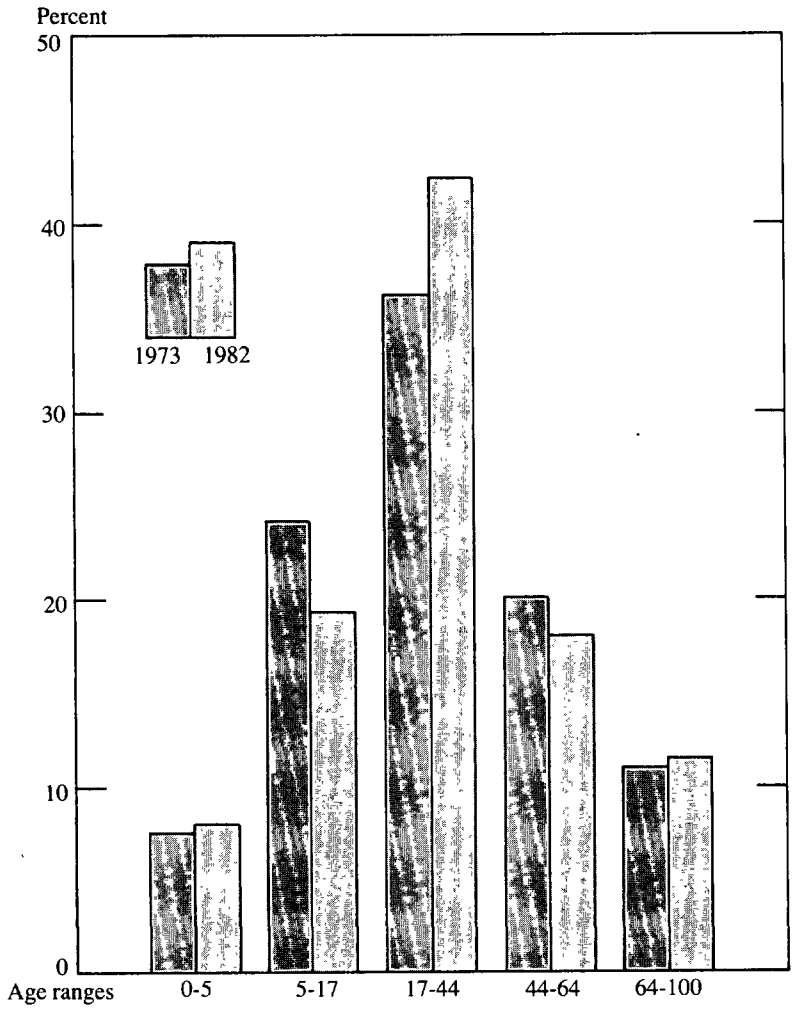
CHART 6
Growth in federal transfers,
Tenth District states



Source: State Government Finances, Bureau of the Census

economic performance — and hence on budgets — than the 1974-75 recession. Though personal income continued to grow during both recessions, the growth rate dipped to 6.4 percent in 1982, compared with 8.8 percent in 1974. The district's unemployment rate peaked at 8.3 percent in the fourth quarter of 1982, while in the previous recession it peaked at 6.6 percent. Moreover, employment growth in district states continued in 1974 and 1975, but total district employment declined in 1982.

CHART 7
Age distribution of Tenth District population

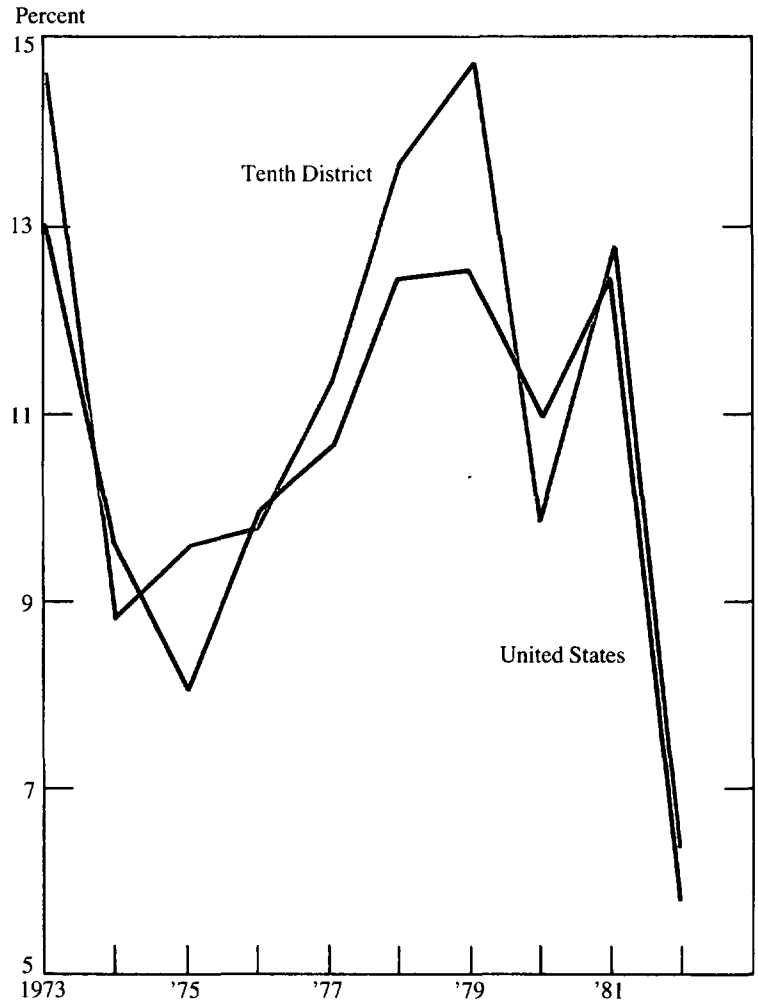


Source: Bureau of the Census

Budget challenges of the future

As district states look to the future they find themselves in a more complex budget-making situation than in the past. Lingering effects of the sharp recession in 1981-82, declining revenue support from the federal government, high interest rates on bonded indebtedness, changing demographics — these and other factors pose problems for the states.

CHART 8
Personal income growth
(annual change)



Source: Bureau of Economic Analysis, Department of Commerce

Future revenue growth

The strength of the district's economy will be a primary determinant of state revenue growth. The traditional source of district strength — its diversity — did not prevent the states from feeling the effects of the sharp recession in 1981-82, mainly because the two most important countercyclical industries, energy and agriculture, also were suffering. And, as energy and agriculture have seen their fortunes interwoven with national and world

economic activity, growth for the region's economy may no longer be as insulated from national business cycles as in the past. As a result, the future of the district economy seems to be more closely tied to a sustained recovery of the U.S. economy and the economies of U.S. trading partners.

Moderate growth in state revenue can be expected on the basis of economic growth. The strong recovery now underway in most of the district is likely to slow somewhat by 1984. Over the longer run, the regional economy will continue to grow, though probably slower than the rapid pace of the 1960s and early 1970s. Strength will be found in an expanding high technology sector and continued dependence on the district's rich reserves of natural resources — oil, gas, coal, and farmland. On the other hand, a fairly stable population and delays in replacing needed public infrastructure may be two sources of regional economic weakness.

The public's willingness to support more taxes also will influence revenue growth. Effects of the 1978 taxpayer revolt still reverberate through district states. But while states have had difficulty in raising taxes to ease the fiscal strain of recent years, a consensus supporting higher taxes likely will build as the public realizes government services increasingly are unmet. Concerns over declines in public education, for example, may foreshadow increasing willingness to fund higher levels of educational services. Necessary additional taxes, however, may increasingly take the form of user fees and consumption taxes, such as sales taxes.

The ability of state governments to fund capital outlays through bond issues also will affect growth in available revenues. District states responded to high interest rates by increasing their long-term debt only 1.8 percent in 1982, compared with 20 percent in 1981. Although nominal interest rates may remain below their 1981 peaks, real interest rates — the inflation-adjusted cost of carrying debt — is likely to remain higher than in the 1970s for the next year or two because of large prospective federal deficits and strong private sector credit demand. As long as interest rates remain high by historical standards, district states probably will continue to refrain from rapid debt issuance. As a result, more capital expenditures may be funded through general revenue.

Future expenditure growth

Changing demographics will continue to heavily influence district state budgets and the services states provide. The population is expected to continue aging for the next two decades as the baby-boom generation further matures and the average life span increases. While education services for the children of baby-boom parents will be needed, conflicting public demands on state revenue may make providing this service more difficult so that new ways of funding education may be needed. Public health services will be in greater demand as the proportion of older people in the population increases. These demands will present a significant challenge to district states, especially if health-care costs continue rising faster than inflation overall.

Prospective cutbacks in federal public programs also may increase demand for state-funded programs. Cutbacks in such federal programs as food stamps, public housing, and certain specialized public assistance programs already have created more demand for state expenditures. Federal programs are likely to remain austere as projected large federal deficits force reductions in federal spending. Therefore, states may have to assume larger roles in these programs, provided the public

continues to support government assistance at some jurisdiction.

Public infrastructure expenditures are likely to increase rapidly, especially compared with recent growth. High interest rates and fiscal strain prevented many district states from undertaking the capital expenditures needed in recent years. Capital outlays increased little in 1981 and 1982. As a percentage of total state expenditures, capital expenditures fell markedly in both years. Infrastructure needs likely will be high for two reasons. First, the expenditures needed to update existing infrastructure will be great. Many states have used up old investments without making capital improvements to offset deterioration. As a result, many public structures are now in a state of disrepair and large outlays will be needed to bring existing structures to acceptable standards. Second, needs for infrastructure as a foundation for future economic growth also will be great. District states will need to put in place public goods to encourage business and economic growth. Public investment in such things as industrial parks, improved transportation, and cooperative ventures in education, research, and development could be significant.

On balance, expenditures in district states are likely to continue increasing faster than spending by the federal government. Demands for public services will remain high, cutbacks in federal programs will shift some spending to the states, and infrastructure expenditures will be great throughout the 1980s.

Future for budget balancing

With the outlook for moderate growth in revenues and rapid increases in expenditures, the overall outlook for district states depends on their ability to generate revenue that meets spending needs. The fiscal strain district states felt in 1981 and 1982 therefore, may, foreshadow stress for the rest of the 1980s. District states can probably expect the prospect of deficits to shape their actions.

Economic recovery will reduce the strain. A period of sustained regional economic growth could correct many of the fiscal problems district states now face. State fiscal stress always results from cyclical downturns in the economy. District states, therefore, stand to benefit from economic policy that fosters long-term growth in both the national and regional economies. Economic recovery, however, will not solve all the states' fiscal problems. Reduced federal aid to states, prospects for continued high municipal bond rates, aging populations, and urgent infrastructure needs may place stress on state budgets that recovery alone will not relieve. Even if the recovery endures, district states may have to raise taxes or increase other revenues.

District state budgets already may reflect discretionary corrective steps to relieve fiscal strain. In 1982, a year of steep recession across the district, all states except Nebraska and New Mexico increased their fiscal surpluses. State budgets improved because states cut expenditure growth by more than half while raising taxes in some cases. States in the district, therefore, appear willing to address their difficult budget situations by reducing expenditure growth as well as by raising taxes.

As district states look to the future, raising taxes is an obvious possibility in maintaining fiscal balance. The success states have in raising taxes depends not only on the willingness of the public but also on the ability of a state's economy to generate additional tax revenues. The latter factor, which might be termed "tax capacity," is difficult to evaluate.

The Advisory Commission on Intergovernmental Relations (ACIR) has developed a broad index that estimates how much revenue

each state could generate if it taxed all of its tax bases at national average rates. As a measure of fiscal capacity, the index measures the multiple resources claimable by state governments through a variety of taxes.[1] A tax capacity greater than 100 indicates the state has more fiscal capacity than the 50 states as a whole.

Based on this index, Tenth District states appear to have considerable fiscal capacity. All district states except Missouri and Nebraska had index values greater than 100 in 1981, the last year for which estimates are available (Table 5). This means, for example, that Colorado, with an index of 113, had 13 percent more tax capacity than the rest of the nation. Missouri, on the other hand, with an index of 92, had 8 percent less tax capacity than the rest of the United States. Wyoming, with an index of 216, was second only to Alaska in tax capacity. The high number assigned to Wyoming reflected that state's rich mineral wealth. Overall, the Tenth District appears to have a strong tax base to support increased expenditures.

The tax capacity of most district states has increased in recent years. Only Missouri and Nebraska had deterioration in tax capacities between 1967 and 1979. The tax capacity of the other district states increased steadily over the same period. Indeed, New Mexico, Oklahoma, and Wyoming showed stronger growth in tax capacity than much of the rest of the nation. The region's growing economy and rich supply of natural resources were largely responsible for the general growth in tax capacity.

The ability to raise additional taxes also depends on how much of a state's tax capacity has already been used. The ACIR generates an index of tax effort that measures a state's total tax collections relative to its total tax capacity. A tax effort greater than 100 indicates that the state is taxing its overall base at higher than average rates.

The Tenth District appears to have substantial capacity for generating additional revenue. All seven states had tax effort index numbers less than 100 in 1981, suggesting that tax collections in the district were running well below the national average (Table 5). Only Nebraska even approached the average tax effort in 1981. Index numbers over the 1967-81 period show that, except for Nebraska, district states actually had reduced tax collections relative to the national average over time. Thus, the relatively high tax capacity of district states coupled with relatively low tax collections suggest that considerable additional tax revenues could be raised. Whether these additional revenues are realized depends, of course, on the voters in the various states.

States will continue to use income taxes as a revenue mechanism, but other taxes may be proposed. Additional severance taxes may be important in energy-rich states. States also will turn increasingly to user charges for state services and consumption-type taxes, such as sales taxes. Fiscal strain has made district states more aware of their costs, increasing the likelihood that they will respond to revenue shortfalls more quickly in the future. Although demand for expenditures will be great, new and old spending programs are likely to be scrutinized carefully. Capital expenditures also are likely to be undertaken only after careful consideration of short- and long-run objectives.

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[1] Advisory Commission On Intergovernmental Relations, *Tax Capacity of the Fifty States: Methodology and Estimates*, Report No. M-134, Washington, D.C., March 1982. The ACIR was created by Congress in 1959 to monitor the operation of the American federal system and to recommend improvements. It is a permanent, national, bipartisan body representing the executive and legislative branches of federal, state, and local government and the public.

TABLE 5
Tax capacity and tax effort in Tenth District states

	Tax Capacity				Tax Effort			
	1967	1977	1979	1981	1967	1977	1979	1981
Colorado	104	107	110	113	106	95	96	84
Kansas	105	109	109	109	96	89	87	87
Missouri	97	96	97	92	86	80	82	81
Nebraska	110	101	100	97	78	98	98	95
New Mexico	94	98	103	114	92	77	85	89
Oklahoma	102	101	108	127	80	72	74	73
Wyoming	141	154	173	216	79	82	83	73
United States	100	100	100	100	100	100	100	100

Source: Advisory Commission on Intergovernmental Relations, 1981 *Tax Capacity of the Fifty States*, Report No. A-93, Washington, D.C., September 1983.

Summary

Tenth District states, like other states in the nation, have had declining state budget balances over the past decade, and in some cases budget deficits. The problems have been particularly severe in states that rely heavily on manufacturing, energy, or agriculture as engines of economic activity. The stress has increased in recent years as a result of recession, cutbacks in federal assistance programs, and an aging infrastructure and population base.

Economic recovery will solve many state budget problems, as it has in past recoveries. Overall, district states can expect reasonably strong economic growth to support adequate tax revenues. Most district states may be able to carry fiscal surpluses. Many of the factors that have placed budgets under stress, however, will necessitate prudent and careful budget planning. That planning may result in additional actions to cut budgets and to raise revenues. Since most district states tax their citizens less than other states, most of the states have the potential tax revenue to solve budget problems that may arise — provided revenue increases meet voter approval.

The Impact of Discount Rate Changes on Market Interest Rates

By V. Vance Roley and Rick Troll

The Federal Reserve's discount rate — the rate charged to depository institutions borrowing from Federal Reserve banks — was more important in the implementation of monetary policy in the three years after the Federal Reserve changed its monetary control procedures in October 1979.[1] Until then, the Federal Reserve had focused on short-term market interest rates in attempting to achieve monetary growth objectives. In the three years after the change, however, the Federal Reserve focused mainly on the availability of reserves to depository institutions. As a result, borrowing at the discount window — a component of total reserves of depository institutions — took on more significance, as did the cost of borrowing represented by the discount rate.

This article analyzes the economic significance of discount rate changes by comparing market interest rates just before an announced discount rate change with market interest rates immediately after. Unlike other studies on this subject, the analysis examines the responses of both short and long-term interest rates.[2] By considering the response of the whole term structure of interest rates, possible effects associated with both short and long-run monetary policy objectives can be investigated. Of particular interest is the notion that long-term yields may fall (rise) in response to an

[1] For the descriptions of the operating procedures adopted by the Federal Reserve on October 6, 1979 and comparisons with the previous approach, see J. A. Cacy, "Monetary Policy in 1980 and 1981," Economic Review, Federal Reserve Bank of Kansas City, December 1980, pp. 18-25; and Stephen Axilrod and David E. Lindsey, "Federal Reserve System Implementation of Monetary Policy: Analytical Foundations of the New Approach," American Economic Review, May 1981, pp. 246-52.

V. Vance Roley is an associate professor of finance at the University of Washington and a visiting scholar at the Federal Reserve Bank of Kansas City. Rick Troll was an assistant economist at the Bank. The views expressed here are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Kansas City or the Federal Reserve System.

[2] While other research has not examined the impact on the entire term structure of interest rates, the impact on a variety of markets has been studied. See, for example, Roger Waud, "Public Interpretation of Federal Reserve Discount Rate Changes: Evidence on the 'Announcement Effect'," Econometrica, March 1970, pp. 231-50; Raymond E. Lombra and Raymond G. Torto, "Discount Rate Changes and Announcement Effects," Quarterly Journal of Economics, February 1977, pp. 171-76; Douglas R. Mudd, "Did Discount Rate Changes Affect the Foreign Exchange Value of the Dollar During 1978?" Review, Federal Reserve Bank of St. Louis, April 1979, pp. 20-6; H. Kent Baker and James M. Meyer, "Impact of Discount Rate Changes on Treasury Bills," Journal of Economics and Business, Fall 1980, pp. 43-8; Kathleen Hope Brown, "Effect of Changes in the Discount Rate on the Foreign Exchange Value of the Dollar: 1973 to 1978," Quarterly Journal of Economics, August 1981, pp. 551-58; Daniel

increase (decrease) in the discount rate if such an increase reflects a policy objective of lower long-run monetary growth and, hence, lower inflation. As is argued here, however, the opposite response may be seen if discount rate changes instead reflect changes in only short-run monetary growth objectives.

The first section examines the response of market interest rates to new monetary policy information in a simple analytical model. Also considered is the potential role of discount rate changes in conveying new monetary policy information. The effect of discount rate changes under other operating procedures is analyzed in the second section. The third section empirically examines the response of the term structure of interest rates before October 1979 and since that time. The main conclusions of the article are summarized in the final section.

New monetary policy information and interest rates

If announced changes in the discount rate affect market interest rates, they do so primarily by providing the public new information about monetary policy objectives. In other words, changes in the discount rate may have "announcement effects" regarding a change in monetary policy.[3] The precise nature of the announcement effects cannot be readily discerned in other studies. In this section, an analytical framework is provided for identifying the possible sources of announcement effects.[4] Then, the impact of new information about monetary policy objectives on market interest rates is analyzed.

Model of interest rate determination

Market interest rates can be influenced significantly by changes in both short and long-run monetary policy objectives. To characterize long-run monetary objectives, it is assumed that the Federal Reserve focuses on a single monetary aggregate. A long-run path, represented by the line LR in Figure 1, is then assumed to be set from a base level that was observed some in weeks previously (m^B_{t-n}).[5] This long-run path represents trend monetary growth well into the future. In contrast, actual long-run targets specified by the Federal Reserve are in terms of annual ranges. It may nevertheless be reasonable to expect market

L. Thornton, "The Discount Rate and Market Interest Rates: What's the Connection?" Review, Federal Reserve Bank of St. Louis, June-July 1982, pp. 3-14; and Gordon H. Sellon, Jr. and Diane Seibert, "The Discount Rate. Experience Under Reserves Targeting," Economic Review, Federal Reserve Bank of Kansas City, September-October 1982, pp 3-18.

[3] See, for example, Warren Smith, "Instruments of General Monetary Control," National Banking Review, September 1963, pp. 47-76, and Roger Waud, "Public Interpretation of Federal Reserve Discount Rate Changes: Evidence on the 'Announcement Effect'," Econometrica, March 1970, pp. 231-50

[4] The model in this and the following sections is a simplified version of that presented in V. Vance Roley and Carl E. Walsh, "Monetary Policy Regimes, Expected Inflation, and the Response of Interest Rates to Money Announcements," Working Paper No. 1181, National Bureau of Economic Research, August 1983. Also see Thomas J. Urich, "The Information Content of Weekly Money Supply Announcements," Journal of Monetary Economics, July 1982, pp. 73-88, and Peter A. Tinsley, Peter von zur Muehlen, Warren Trepeta, and Gerhard Fries, "Money Market Impacts of Alternative Operating Procedures," in New Monetary Control Procedures, Federal Reserve Staff Study — Volume II, Board of Governors of the Federal Reserve System, February 1981.

[5] Long-run target values of the money stock may be represented as

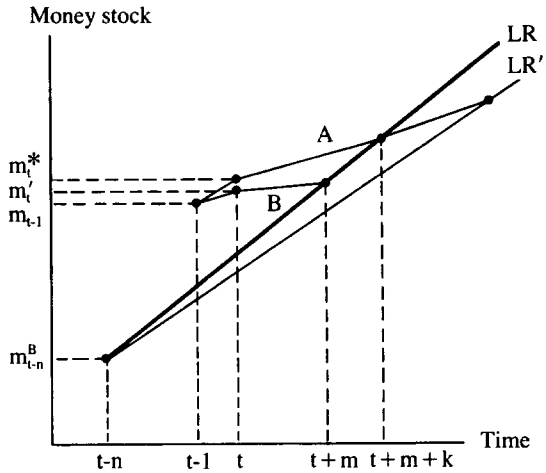
$$M^T_{t+j} = (1+g)^{n+j} M^B_{t-n}, \quad (1)$$

where M^T_{t+j} is the target level of the money stock in week t+j, M^B_{t-n} is the base level of the money stock in week t-n, and g is the weekly growth rate implied by the annual target rate. For the derivations that follow in this article, it is useful to take logarithms of both sides of(1) to yield

$$m^T_{t+j} = (n+j)g + m^B_{t-n}, \quad (2)$$

where m^T_{t+j} is log (M^T_{t+j}), and m^T_{t-n}, is log (M^B_{t-n}).

FIGURE 1
Short and long-run monetary paths



participants to infer a long-run money path extending beyond one year based on past Federal Reserve actions and statements related to trend money growth.

A variety of unanticipated disturbances in the financial and nonfinancial sectors of the economy can cause short-run money growth to deviate substantially from its desired long-run rate. Suppose at the beginning of the current week (t), for example, the Federal Reserve estimates that money in the previous week (t-1) increased faster than the desired trend. In the model, it is assumed that the Federal Reserve then specifies a short-run money path consistent with eventually obtaining the long-run path, as represented by either line A or B in the figure.[6] In the figure, short-run path A implies slower adjustment back to the long-run path than path B. Consequently, the level of the money stock is higher under path A for a number of weeks (m + k).

The assumptions underlying the short-run paths again depart from actual Federal Reserve policymaking behavior. The model assumes that new short-run money paths are specified every week, so that they represent the best forecast of actual money stock behavior. In contrast, short-run paths specified by the Federal Reserve are typically set only at FOMC meetings and are, therefore, not adjusted weekly to reflect actual money growth. The counterfactual assumptions concerning monetary targets are presented merely for expositional and analytical ease and do not significantly change any of the main results. In the remainder of the article, monetary policy objectives are discussed in terms of this analytical framework.

The alternative short-run paths in Figure 1 have different implications for the level of interest rates. To see this, the demand for money must be considered. In Figure 2, the demand for money in week t (m_t^D) is graphed as a negative function of the federal funds rate.[7] The relationship reflects the desire of households and businesses to economize on their money holdings as interest rates rise. Money demand depends on other factors — such as income, wealth, and prices — that would cause the relationship in the figure to shift if their values changed.

From the short-run path for money in Figure 1, the target levels of money from the current

[6] The short-run path may be represented as

$$m_{t+j} = (n+j)g + m_{t-n}^B + (1-\lambda)^j [m_{t-1} - (n-1)g - m_{t-n}^B], \quad (3)$$

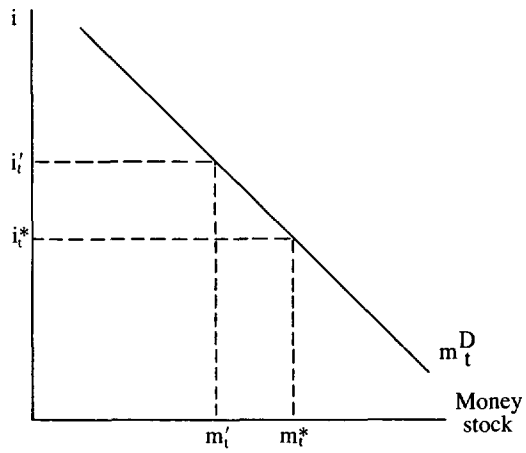
where m_{t-j} is the short-run target level of the money stock in week t + j as of week t, and is the rate at which the deviation of money from its long-run target is offset.

[7] Other short-term interest rates may more appropriately represent the opportunity cost of holding money. To simplify the analysis, however, the federal funds rate is assumed to be a representative short-term yield. Analytically, the money demand function considered hence may be represented as

$$m_t = a_0 - a \cdot i_t + u_t, \quad (4)$$

where a_0 and a are positive parameters and u_t is a random error term. Because of lagged reserve requirements it is assumed

FIGURE 2
Money market



week (t) through a number of subsequent weeks may be determined. Also, given the target level of money in week t (m_t^*, for example), the federal funds rate consistent with this level (i_t^*) may be determined from the money demand function in Figure 2. Because the money path in Figure 1 embodies levels of the money stock for a number of subsequent weeks, future levels of the federal funds rate are also implicit in the model. For example, the money stock target for the next week can be inferred from Figure 1, and, in turn, an implied level of next week's federal funds rate can be obtained from the money demand function. Levels of the federal funds rate in subsequent weeks can be derived the same way, again conditional on the information available in the current week (t). As a result, the current path for money has implications for both the federal funds rate and longer term interest rates if longer term rates reflect expected future levels of the federal funds rate.[8] In the case of a one-month yield, for example, it may be expected to be an average of the current week's federal funds rate plus the levels of the federal funds rate over the next three weeks. Thus, any change in policy affecting either the current week's federal funds rate or its level in the future would be expected to affect this yield.

Change in short-run monetary policy objectives

If new information about short-run monetary policy objectives becomes available, market interest rates may move from their previous level. In examining this case, suppose that in the current week (t), both the Federal Reserve and the public observe that available data on the money stock indicate higher than desired money growth, as in Figure 1. Based on past Federal Reserve behavior, financial market participants may expect a short-run money path corresponding to path A in the figure. This path has implications, as previously discussed, for the levels of current and future short-term interest rates. Now suppose that new information available to the public suggests the Federal Reserve's implied short-run money path has moved from path A to path B in Figure 1. As a result, the current week's target as assessed by the public has decreased from m_t^* to m_t' in Figures 1 and 2. In an effort to achieve this reduced level of the money stock, the federal funds rate is expected to rise from i_t^* to i_t'.

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that only the demand for needs to be considred in any given week to determine the desired level of the federal funds rate. This property is discussed in detail below.

[8] Analytically, this term structure relationship is

$$r_{m,t} = (1/m)\, i_t + (1/m) \sum_{j=1}^{m-1} E_t\,(i_{t+j}), \qquad (5)$$

where $r_{m,t}$ is the yield on an m-week security in week t, and $E_t(\ )$ is the expectations operator conditional on information available in week t.

Long-term interest rates also can be affected by changes in short-run monetary policy objectives. If the anticipated short-run path is again moved from path A to path B in Figure 1, expected levels of the money stock are less than those previously expected for m + k weeks. From Figure 2, this reduction implies higher expected levels for the federal funds rate over this period. If long-term yields reflect these expected future levels of short-term interest rates, long-term yields also would rise.

Change in long-run monetary policy objectives

New information about long-run monetary policy objectives also may affect market interest rates. In examining this case, it is convenient to assume that the public's assessment of the short-run path is unchanged. Suppose, for example, the current short-run path is path A and the current long-run path is LR, as both are represented in Figure 1. Now assume that the public receives new information suggesting that the long-run path has moved from LR to LR′. In this instance, the current federal funds rate would remain unchanged since the assessed target for money in the current week is unchanged. This result follows because short-run money growth is still expected to follow path A. Thus, because expected levels of the money stock are unchanged for m + k weeks into the future, expected levels of the federal funds rate for the current and m + k future weeks should be unchanged.

After m + k weeks, expected levels of the money stock are uniformly lower than before. These lower future levels of the money stock imply higher future short-term interest rates after m + k weeks, as in Figure 2. However, a permanent reduction in the growth of the money stock would reduce expected inflation, which would lower future expected short-term interest rates.[9] This latter effect would be more likely to dominate the longer the maturity of the security. Thus, long-term interest rates may decline immediately if trend monetary growth is reduced and the current short-run money path is maintained.

Impact of discount rate changes under alternative operating procedures

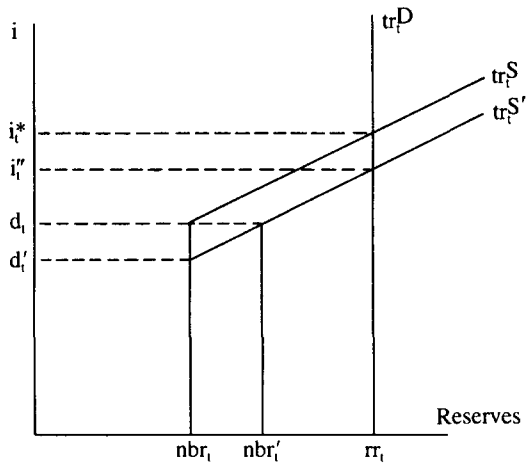
The potential role of changes in the discount rate in revealing information about either short or long-run monetary policy objectives depends on the type of operating procedure the Federal Reserve uses. This section examines the effect of discount rate changes under federal funds rate and nonborrowed reserves operating procedures. To consider these different operating procedures, a model of the reserves market is presented first.

Model of the reserves market

The determination of the federal funds rate consistent with the desired level (i_t*) implied by Figures 1 and 2 may be represented in the market for reserves. The demand for and supply of reserves are represented graphically in Figure 3. The demand for total reserves is comprised of required reserves and excess reserves. For simplicity, it is assumed that excess reserves equal zero and that uniform reserve requirements are imposed on all components of the money stock. Because of

[9] Note that nominal money demand in the future would decrease, leading to a lower implied level of the federal funds rate. To analyze this effect properly, the nonfinancial economy and an adjustment mechanism describing movements in prices should be added to the model. It is assumed throughout this article that prices are not flexible in the short run. In particular, it is assumed that inflationary expectations are unaffected unless the long-run target path is changed.

FIGURE 3
Reserves market



lagged reserve requirements, however, the current demand for required reserves (rr_t) depends on the deposits of financial institutions in the statement week before last. Since the demand for reserves depends only on a previous level of the money stock, and not current short-term interest rates, it can be represented by the vertical line (tr_t^D) in the figure.[10]

The supply of reserves to depository institutions (tr_t^S) also consists of two components: borrowed reserves from the Federal Reserve's discount window and nonborrowed reserves. Nonborrowed reserves (nbr) can be closely controlled by the Federal Reserve through open-market operations — temporary or outright purchases and sales of securities. In the absence of policy considerations, the supply of nonborrowed reserves is also insensitive to interest rates. So, as before, it can also be represented in the figure by a vertical line.

The other component, borrowed reserves, depends mainly on the spread between the federal funds rate and the discount rate.[11] The federal funds rate — the daily rate charged on reserves borrowed from other financial institutions — represents a cost of obtaining reserves in the short run. For depository institutions to borrow from the Federal Reserve, the federal funds rate must be sufficiently higher than the discount rate to compensate for any nonpecuniary costs associated with discount window borrowing.[12] For analytical convenience, it is assumed that discount window borrowing equals zero when the federal funds rate is at or below the discount rate and that discount window borrowing increases as the positive spread between the federal funds rate and the discount rate widens. Given these assumptions, the supply of total reserves simply equals nonborrowed reserves for levels of the federal funds rate (i_t) below the discount rate (d_t), and equals the sum of nonborrowed and borrowed reserves for higher levels of the federal funds rate.[13] In this framework, the level

[10] Analytically, the demand for total reserves (TR^D) may be represented as

$$TR_t^D + RR_t^D + ER_t^D. \quad (6)$$

Since it is assumed that the demand for excess reserves equals zero ($ER^D = 0$), and that required reserves are proportional to the lagged money stock ($RR^D = kM_{t-2}$), the logarithm of the demand for total reserves may be expressed as

$$tr_t^D = rr_t^D + k + m_{t-2}. \quad (7)$$

[11] For detailed analyses of depository institutions' short-run reserves adjustments, see Stephen M. Goldfeld and Edward J. Kane, "The Determinants of Member Bank Borrowing: An Econometric Study," Journal of Finance, September 1966, pp 499-514; Peter A. Frost and Thomas J. Sargent, "Money Market Rates, the Discount Rate, and Borrowing from the Federal Reserve," Journal of Money, Credit, and Banking, February 1970, pp. 56-82; and Marvin Goodfriend, "Discount Window Borrowing, Monetary Control, and the Post-October 6, 1979 Federal Reserve Operating Procedure," Working Paper No. 81-1, Federal Reserve Bank of Richmond, January 1981.

[12] The costs reflect a possible administrative burden due to the guidelines governing access to the discount window, the reluctance of institutions to use their limited borrowing privilege, and a traditional unwillingness of some banks to borrow from the Federal Reserve at all.

of the federal funds rate (i_t*) consistent with Figure 2 is determined by the intersection of the demand for and supply of reserves in Figure 3.[14]

Federal funds rate operating procedure

Under the pre-October 1979 monetary control procedure, the Federal Reserve adjusted the supply of nonborrowed reserves to maintain the federal funds rate within a narrow band. If the desired level of the federal funds rate is i_t'', for example, the supply of nonborrowed reserves could be increased from nbr_t to nbr_t' to achieve this rate. In this case, the supply of total reserves shifts from tr_t^S to $tr_t^{S'}$, as illustrated in the figure.

Taken by themselves, discount rate changes would not reflect any new information about monetary policy objectives under a federal funds rate operating procedure. If the discount rate is d_t' and the current week's federal funds rate is i_t'', for example, an increase in the discount rate to d_t would result in nonborrowed reserves increasing from nbr_t to nbr_t' in Figure 3. In this case, the assessed target for the current week's money stock would remain the same as before. In contrast, if the federal funds rate changed from its previous level, this change would reveal new information about current and future levels of the money stock. An increase in the federal funds rate, for example, implies that the current week's expected money stock is less than before, as shown in Figure 2. Discount rate changes would not convey any new information since they are not needed to change the level of the federal funds rate. Thus, under a federal funds rate operating procedure, discount rate changes would not be expected to affect market interest rates.

Nonborrowed reserves operating procedure

Under the post-October 1979 operating procedure, the Federal Reserve maintained a target path for nonborrowed reserves, thereby allowing larger fluctuations in the federal funds rate. For a given level of required reserves (rr_t, for example), if borrowing demand was higher than expected, the total supply of reserves would shift from tr_t^S to $tr_t^{S'}$ in the figure. With a fixed supply of nonborrowed reserves, the federal funds rate would drop from i_t* to i_t''.

Under a nonborrowed reserves operating procedure, a discount rate change would be expected to affect interest rates without any

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[13] The supply of total reserves (TR_t^s) can be expressed as

$$TR_t^s = RR_t = NBR_t + BR_t \quad (8)$$

where NBR_t and BR_t are the levels of nonborrowed and borrowed reserves, respectively. Rearranging (8) and taking logarithms yields

$$rr_t = nbr_t + \ln(1 + BR_t/NBR_t), \quad (9)$$

where rr_t and nbr_t are the logarithms of RR_t and NBR_t, respectively. To represent the discount-window borrowing behavior of depository institutions, it is assumed that

$$\ln(1 + BR_t/NBR_t) = b_0 + b(i_t - d_t) + v_t \quad (10)$$

for it d_j, and zero otherwise, where b_0 and b are positive parameters, and v_t is a stochastic error term. From (9) and (10), the supply of reserves therefore equals

$$rr_t = nbr_t + b_0 + b(i_t - d_t) + v_t. \quad (11)$$

[14] Because of lagged reserve requirements, it is assumed that there is not a direct link between the demand for reserves and the current level of the money stock in any given week in the model. For other analyses emphasizing this property, see Stephen F. LeRoy, "Monetary Control Under Lagged Reserve Accounting," Southern Economic Journal, October 1979, pp. 460-470; David S. Jones, "Contemporaneous vs. Lagged Reserve Accounting: Implications for Monetary Control," Economic Review, Federal Reserve Bank of Kansas City, November 1981, pp. 3-19; and Robert L. Hetzel, "The October 1979 Regime of Monetary Control and the Behavior of the Money Supply in 1980," Journal of Money, Credit, and Banking, May 1982, pp. 234-251. For an analysis of money stock determination under contemporaneous reserve requirements, also see Howard L. Roth and Diane Seibert, "The Effect of Alternative Discount Rate Mechanisms on Monetary Control," Economic Review, Federal Reserve Bank of Kansas City, March 1983, pp. 16-29.

further overt policy actions. In particular, if nonborrowed reserves are fixed in week t, a decrease in the discount rate from d_t to d_t' in Figure 3, for example, causes the federal funds rate to fall from i_t^* to i_t''. In this case, the shift in the supply of reserves reflects the increased willingness of banks to borrow at any given federal funds rate. The subsequent fall in the federal funds rate causes market participants to revise their estimate of the current week's money stock upward. The public may further infer a change in the entire short-run money stock path, causing the discount rate change to affect both short and long-term interest rates. Thus, under a nonborrowed reserves operating procedure, changes in the discount rate reflect changes in at least the short-run money path.[15] Discount rate changes also may reflect simultaneous changes in both short and long-run monetary policy objectives, making their impact on long-term interest rates ambiguous.

Response of interest rates to discount rate announcements: empirical results

This section empirically examines the response of the term structure of interest rates to announced changes in the discount rate and analyzes the results in the context of the previous two sections. The model used in the empirical work is discussed next, followed by the presentation of the estimation results.

The model

An efficient markets model was used to examine the relationship between discount rate announcements and changes in market interest rates. The model assumes that market participants use all the information available to the public efficiently in determining interest rates in the money and capital markets. Yields on all Treasury securities should reflect the expectations of investors regarding the discount rate and other pertinent announcements.

The primary implication of this application of the model is that daily changes in interest rates should depend only on new information received between closing quotations at the end of successive business days. As a result, the market's best forecast of the next day's close is the observed yield at the close of the current business day. Thus, any unexpected announcement of a change in the discount rate or new information obtained from an economic release may affect the yield on Treasury securities immediately. Since other empirical work has indicated that economic releases not directly related to monetary policy did not significantly affect Treasury bill yields, the only other announcements included in the model are money stock releases.[16]

Because only new information should affect

[15] The public and the Federal Reserve also are implicitly assumed to have the same information about the position of the demand for money schedule in Figure 2. Thus, changes in the discount rate are not assumed to represent new public information about money demand. For similar interpretations, see Peter Keir, "The Impact of Discount Policy Procedures on the Effectiveness of Reserve Targeting," in New Monetary Control Procedures, Federal Reserve Staff Study — Volume I, Board of Governors of the Federal Reserve System, February 1981, and Fred J. Levin and Paul Meek, "Implementing the New Operating Procedures: The View from the Trading Desk," in New Monetary Control Procedures, Federal Reserve Staff Study — Volume I, Board of Governors of the Federal Reserve System, February 1981.

[16] 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. Money stock announcements were included to avoid biasing results when a discount rate announcement and a money announcement occur on the same day. There were nine such occurrences in the sample period under consideration.

market interest rates, the unexpected component of a discount rate change should be used to determine its effect. Discount rate changes, however, have sometimes been interpreted as merely reflecting past movements in short-term market interest rates.[17] In such instances, the motive for changing the discount rate is to realign it with the federal funds rate. As illustrated in Figure 3, the larger the spread between these two rates, the higher the level of borrowing. Thus, the discount rate may be increased, for example, if discount window borrowing is thought to be excessive because of recent increases in the federal funds rate.

If discount rate changes can be predicted from past movements in the federal funds rate, an announced change should not affect market interest rates. Even if the announced change coincided with a recent change in short-run monetary policy objectives, the change would already be incorporated into market yields. This result follows under either operating procedure, since no new information is provided by the announcement.

The relationship between past movements in the federal funds rate and discount rate changes is examined in Table 1. The empirical relationship related daily movements in the discount rate — which are zero unless a discount rate change is announced — to the cumulative change in the federal funds rate since the last discount rate announcement. This specification implies that changes in the discount rate result from cumulative increases or decreases in the spread between the federal funds rate and the discount rate. The model further allowed for possible differential effects of positive and negative movements in the funds rate and positive movements larger than one percentage point.

With this model, cumulative changes in the federal funds rate were found to be related to announced discount rate changes. However, increases in the federal funds rate of less than one percentage point were not significantly related to discount rate changes. This result possibly indicates a reluctance by the Federal Reserve to adjust the discount rate often to dampen volatility in short-term interest rates. The predictive power of the equation is somewhat higher in the second period than in the first. In both periods, however, only a small part of the variation in discount rate changes is explained. As a result of this low explanatory power, the entire change in the discount rate is assumed to be unanticipated.[18]

Response of Treasury security yields to discount rate announcements

The efficient markets model was used to investigate the response of the term structure of interest rates to discount rate announcements both before and after the Federal Reserve changed its operating procedures. Unexpected changes in the money stock were constructed by taking the difference in the actual announced change in the narrow monetary aggregate and the median of market survey.[19] The announced changes in the discount rate were used, since no survey measure incor-

[17] See, for example, Raymond E. Lombra and Raymond G. Torto, "Discount Rate Changes and Announcement Effects," Quarterly Journal of Economics, February 1977, pp. 171-176.

[18] These results do not necessarily mean that changes in the discount rate are mostly unanticipated. These results may instead reflect the difficulty in predicting the exact timing of a discount rate announcement. In addition, other factors, including statements by Federal Reserve officials and trends in open market operations may also provide information about the timing of discount rate changes not captured in the equations investigated here.

[19] See V. Vance Roley, "Weekly Money Supply Announcements and the Volatility of Short-Term Interest Rates," Economic Review, Federal Reserve Bank of Kansas City, April 1982, pp. 3-15.

TABLE 1
Discount rate announcements and past changes in the federal funds rate

Estimation Period	Constant	ΔRFF^-	ΔRFF^+	ΔRFF^{++}	$\bar{R}^2$	DW
9/29/77-	0.0051	0.0090	0.0173	0.0317*	.012	2.01
10/05/79	(0.0049)	(0.0238)	(0.0176)	(0.0110)		
10/08/79-	-0.0089	0.0049	0.0104	0.0104*	.014	1.92
10/15/82	(0.0086)	(0.0038)	(0.0223)	(0.0045)		

*Significant at the 5 percent level. Estimated standard errors in parenthesis.
Note: The equations were estimated in the following form:
where

$\Delta RD_t = b_0 + b_1 \cdot \Delta RFF_t^- + b_2 \cdot \Delta RFF_t^+ + b_3 \cdot \Delta RFF_t^{++} + e_t$, where

ΔRD_t = announced change in discount rate

ΔRFF_t^- = decline in federal funds rate since last discount rate announcement; 0 otherwise

ΔRFF_t^+ = rise in federal funds rate since last discount rate announcement between 0 and 1 percentage point, 0 otherwise

ΔRFF_t^{++} = rise in federal funds rate since last discount rate announcement greater than 1 percentage point, 0 otherwise

e_t = random error term

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

DW = Durbin-Watson statistics

b_0, b_1, b_2, b_3 = coefficients

porating both the timing and magnitude of the discount rate changes was available, and empirical equations had marginal explanatory power.

The estimates in Table 2 measure the daily response in security yields to money stock and discount rate announcements. Focusing on the discount rate response, the corresponding coefficient measures the market's reaction to an announcement of a one percentage point change in the discount rate. For example, during the period from September 29, 1977 to October 5, 1979, announcements of a discount rate change did not significantly alter yields on any maturity of Treasury securities tested.[20] Thus, changes in the discount rate in the first period contained little new information and were not interpreted as signaling a change in Federal Reserve policy.

The response in the post-October 1979 period was markedly different. Announced changes in the discount rate affected interest rates across the entire maturity spectrum. For example, the estimated response of 3-month Treasury bills to a one percentage point

[20] The November 1, 1978, discount rate announcement was dropped from the sample. In this case, the change in the discount rate was announced as part of a broad program designed to help stabilize the exchange value of the dollar. It was thought that the effect of the other measures taken at that time could not be adequately explained within the empirical framework used in this study. It has been noted by other authors (for example, Albert J. Wojnilower, "The Central Role of Credit Crunches in Recent Financial History," Brookings Papers on Economic Activity, 2:1980, pp. 277-326) that long-term rates declined dramatically on this date, contrary to expectation. Indeed, inclusion of this date alters the empirical results. While short-term rates still exhibit no response to discount rate announcements, long-term rates are found to move significantly in the opposite direction of the discount rate changes.

TABLE 2
Discount rate announcements and the term structure of interest rates

September 29, 1977 - October 5, 1979

Dependent Variable	Constant	ΔRD	UM1	Summary Statistics $\bar{R}^2$	SE	DW
ΔR3M	0.0251*	0.0974	0.0167*	.058	.106	1.873
	(0.0107)	(0.0677)	(0.0067)			
ΔR1Y	0.0215*	0.0659	0.0160*	.088	.077	1.843
	(0.0078)	(0.0580)	(0.0049)			
ΔR5Y	(0.0078)	0.0574	0.0082*	.092	.043	1.883
	(0.0044)	(0.0324)	(0.0027)			
ΔR10Y	0.0072	0.0056	0.0029	-.003	.037	1.672
	(0.0038)	(0.0282)	(0.0024)			
ΔR20Y	0.0056*	0.0233	0.0023	.009	.029	1.936
	(0.0029)	(0.0217)	(0.0018)			

October 8, 1979 - October 15, 1982

Dependent Variable	Constant	ΔRD	UM1	Summary Statistics $\bar{R}^2$	SE	DW
ΔR3M	0.0691*	0.5550*	0.1026*	.290	.381	1.941
	(0.0292)	(0.1090)	(0.0149)			
ΔR1Y	0.0382	0.4495*	0.0967*	.349	.300	2.079
	(0.0230)	(0.0858)	(0.1173)			
ΔR5Y	0.0418*	0.2296*	0.0558*	.258	.207	2.136
	(0.0158)	(0.0590)	(0.0081)			
ΔR10Y	0.0366*	0.1376*	0.0396*	.173	.181	2.070
	(0.0138)	(0.0517)	(0.0071)			
ΔR20Y	0.0332*	0.1461*	0.0356*	.151	.181	2.065
	(0.0139)	(0.0519)	(0.0071)			

*Significant at the 5 percent level. Estimated standard errors in parentheses.
Note: The equations are estimated in the following form:
Dependent variable$_t$ = $b_0 + b_1 \cdot \Delta RD_t + b_2 \cdot UM1_t + e_t$
where the U's indicate that only the unanticipated component of the announcement are included.

R3M = yield on 3-month Treasury bill
R1Y = yield on 1-year Treasury constant maturity
R5Y = yield on 5-year Treasury constant maturity
R10Y = yield on 10-year Treasury constant maturity
R20Y = yield on 20-year Treasury constant maturity
RD = discount rate
UM1 = unanticipated announced change in the narrowly defined money stock
e = random error term
$\bar{R}^2$ = multiple correlation coefficient corrected for degrees of freedom
SE = standard error
DW = Durbin-Watson statistic

change in the discount rate was 56 basis points, while the response for 20-year Treasury bonds was 15 basis points. Even though the response of Treasury securities generally decreased as maturity increased, the response of long-term rates was still substantial and more than might be expected from comparisons with the response of short-term rates. Thus, the results suggest that market participants revised not only their assessments of current short-term rates but also their expectations about future short-term rates.[21]

These results can be interpreted in a manner consistent with the analytical model presented in the first section. Before October 1979, market participants did not associate any change in expected money growth with changes in the discount rate. As a result, there was no significant movement in security yields associated with discount rate announcements. After the change in operating procedures, however, market participants began attaching policy significance to discount rate changes. Consistent with the estimated response, investors may have interpreted discount changes as signaling changes in the short-run path for money. Therefore, if an increase in the discount rate was seen as a move by the Federal Reserve to return more rapidly to the long-run path for money, not only would current short-term rates change but also expected levels of future short-term rates. Such a response could produce a change in the term structure of interest rates similar to that seen.

As suggested earlier, a change in the term structure of interest rates in response to a discount rate announcement may be due to a perceived change in both the short and long-run paths for money. For a discount rate increase, current short-term rates may rise while expected future short-term rates fall if a reduction in expected long-run money growth causes a decline in expected inflation. This possibility was tested in Table 3, where the impact of discount rate changes on forward rates was examined. The second row of the table, for example, estimates the impact on the expected four-year yield one year in the future.[22] Similarly, the last row corresponds to the change in the expected 10-year yield ten years in the future. If an increase in the discount rate lowers expected inflation, this latter expected yield, as well as others in the table, would be expected to decline. However, as shown in the table, the estimated response is never significantly below zero. Thus, the

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[21] Under the expectations theory of the term structure of interest rates, if only current short-term rates are affected by discount rate announcements then the response of the long-term rates should be only a small fraction of the short-term rate response. Consider the following example:

$$R20Y = \frac{1}{80}(R3M + R3M_{+3} + R3M_{+6} + \ldots + R3M_{+240})$$

where

$R20Y$ = 20-year bond rate

$R3M_{+i}$ = expected 3-month Treasury bill rate in period i

$R3M$ = current 3-month Treasury bill rate.

If expectations of future short-term rates were unaffected by discount rate announcements, then the change in the 20-year bond rate would be (1/80) times the 3-month response. Using the estimated response of 55 basis points for 3-month Treasury bills, this implies a 0.61 basis point response of the 20-year Treasury bonds. To the extent that the expectations hypothesis about the term structure of interest rates is valid, the estimated response of 15 basis points for 20-year Treasury bonds must be the result of revisions of expectations of future short-term rates. Using the analytic model presented in this paper, it can be shown that the response of the 20-year yield relative to the 3-month yield is explained by the model for a value of λ around 0.25.

[22] The 1-year ahead 4-year forward rate may be approximated by $F(1Y,4Y)_t = 5/4\, R5Y_t - 1/4\, R1Y_t$

where

$R1Y$ = 1-year constant maturity rate

$R5Y$ = 5-year constant maturity rate.

A more accurate approximation is actually used in this article, as reported in Robert J. Shiller, John Y. Campbell, and Kermit L. Schoenholtz, "Forward Rates and Future Policy: Interpreting the Term Structure of Interest Rates," mimeo, Yale University, 1983.

TABLE 3
Discount rate announcements and forward rates in the post-October 1979 period

Dependent Variable	Constant	ΔRD	UM1	Summary Statistics $\bar{R}^2$	SE	DW
ΔF(3M,9M)	0.0280	0.4144*	0.0947*	.334	.299	2.11
	(0.0228)	(0.0854)	(0.0117)			
ΔF(1Y,4Y)	0.0429*	0.1559*	0.0421*	.178	.191	2.12
	(0.0146)	(0.0547)	(0.0075)			
ΔF(5Y,5Y)	0.0271	-0.0303	0.0100	.001	.185	1.96
	(0.0142)	(0.0529)	(0.0072)			
ΔF(10Y,10Y)	0.0219	0.1745*	0.0221*	.035	.286	2.17
	(0.0219)	(0.0819)	(0.0112)			

*Significant at the 5 percent level. Estimated standard errors in parentheses.
Note: The equations are estimated in the following form:
Dependent variable$_t$ = $b_0 + b_1 \cdot \Delta RD_t + b_2 \cdot \Delta UM1_t + e_t$.
F(3M,9M) = 3-month ahead 9-month forward rate
F(1Y,4Y) = 1-year ahead 4-year forward rate
F(5Y,5Y) = 5-year ahead 5-year forward rate
F(10Y,10Y) = 10-year ahead 10-year forward rate
RD = discount rate
UM1 = unanticipated announced change in the narrowly defined money stock
e = random error term
$\bar{R}^2$ = multiple correlation coefficient corrected for degrees of freedom
SE = standard error
DW = Durbin-Watson statistic

empirical evidence presented here does not support the hypothesis that increases in the discount rate lower interest rates by reducing investors' expectations of future inflation.

Conclusions

The results of this study reinforce the view that the discount rate played a significantly larger role in the implementation of monetary policy after the Federal Reserve switched to a reserves-based approach in controlling money. Before October 1979, market yields did not change significantly in response to a discount rate announcement. After the change in operating procedures, interest rates across the maturity spectrum responded to such announcements. Also, the response of long-term rates was found to be quite large. Thus, Federal Reserve actions concerning the discount rate can have an immediate and significant impact on the level of long-term interest rates.

The results provide little to suggest that investors revise expectations of inflation when discount rate changes are announced. The results do suggest, however, that significant new information is provided by discount rate changes. In particular, the evidence generally supports the view that changes in the discount rate represent changes in the expected short-run path of money.

Economic Review
Federal Reserve Bank of Kansas City
Kansas City, Missouri 64198
January 1984, Vol. 69, No. 1