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The Business Situation

The latest readings continue to suggest that the economic expansion has slowed down somewhat in recent months after an unusually sharp first-quarter increase. Consumer spending, which provided a major impetus earlier in the recovery, appears to have weakened for a period during the spring, although the most recent figures suggest that this weakness may well prove to have been temporary. An additional source of slower growth in the second quarter seems to have been a rough leveling-off in the rate of inventory accumulation after this sector had provided a sharp spur to overall growth in the first quarter. The more moderate pace of activity in the second quarter was reflected in a slower growth of industrial production and in a leveling-off of nonfarm payroll employment in May and June. In June, the unemployment rate edged up 0.2 percentage point to 7.5 percent after many months of almost continuous decline. Despite the apparent slowdown of economic growth in the second quarter, the available information suggests that the expansion still has considerable momentum behind it. Indeed, by settling down to a more moderate pace, the expansion may well have improved its prospects for longevity, as well as the prospects for avoiding an early reemergence of capacity pressures in critical industries and resulting upward pressures on prices.

The immediate price situation, to be sure, does not look as good as it did a few months ago, when food and fuel prices were undergoing temporary declines. With recent advances in food prices and with some renewed upward movements in prices of major fuels, the incoming data look less favorable. Nevertheless, a careful reading of the latest price figures does not, on balance, indicate that the underlying rate of inflation has accelerated. For example, consumer prices excluding the volatile food and fuel components rose at a bit over a 5 percent annual rate in May, and wholesale industrial prices over the first half as a whole rose at a surprisingly moderate 3.4 percent rate. Moreover, while second-quarter labor cost data are still incomplete, the rise in average hourly earnings continued at well below the rapid 1974 and 1975 rates of increase.

INDUSTRIAL PRODUCTION, NEW ORDERS, AND INVENTORIES

Industrial production increased in May for the fourteenth consecutive month. The preliminary data indicate that overall output of the nation's mines, utilities, and manufacturing plants rose 0.5 percent, with gains widespread among industries. Nevertheless, this did represent a slowdown from the earlier rate of recovery. Since the trough of the recent business downturn, industrial production has risen 15.8 percent, or more than 1 percent per month according to newly revised data, thus indicating that the recovery has been more robust than previously believed. However, the recent recession was severe by postwar standards, and the overall index has not completely regained its previous peak despite the duration and strength of the recovery.

In May, a particularly strong gain was recorded in the iron and steel industry, where output advanced 3.9 percent. This continued the sharp rebound in steel making that characterized the early months of 1976 and brought the cumulative advance since last December to 15.5 percent. To a large extent, the pickup in steel production is related to the rebound in the production of automobiles. Indeed, although demand for consumer-related flat-rolled steel has been strong, demand from other sources—notably the capital goods and construction industries—has remained relatively depressed. The recent evidence suggests that auto production will not cause steel shortages to develop in the near term. The 1.1 percent increase in output of the motor vehicles and parts industry posted during May was less than half the average increase recorded earlier in the year, and the preliminary data for June show a similar percentage increase in assemblies of domestic passenger cars to an 8.8 million unit annual rate. Contrary to initial fears, the rubber industry strike has not greatly affected auto assemblies, and the usual plant shutdown for the model-year changeover will curtail tire needs temporarily.

Production of business equipment has also displayed recent strength. In May, business equipment production recorded a 1.1 percent gain, following healthy increases in the earlier months of 1976. Despite these gains, however, output in this sector remains almost 7 percent below its previous peak. Business equipment, which includes a wide variety of goods ranging from industrial and farm machinery to equipment used in transport and commercial enterprises, tends to lag in the recovery until utilization of existing productive capacity reaches the point that makes investment in new capital goods attractive.

The latest data on orders received by manufacturers of durable goods suggest that further increases in the output of business equipment are in the offing. According to preliminary estimates, seasonally adjusted new orders for machinery rose by nearly $300 million in May, marking the fifth straight month of sizable growth. Overall, durable goods orders have increased sharply in recent months (see Chart I), rising more than 16 percent in the five months since December. This amounts to an average rise of $1.4 billion per month, compared with $800 million per month during the first nine months of the recovery. The increase in total orders was greater than the rise in shipments in May, the first sizable excess of orders over shipments in nearly two years, resulting in a substantial $1.5 billion increase in unfilled orders. The recent advances in new and unfilled orders augur well for continued activity in the future.

Chart I
CHANGES IN DURABLES MANUFACTURERS' ORDERS
Seasonally adjusted

Source: United States Department of Commerce.

Businesses do, however, seem to be cautious in their plans for expansion and their stockpiling of goods. The data on inventories suggest that there has been some flattening of inventory investment after the acceleration in the winter months. April data on the book value of wholesale and retail trade inventories show a rise of $800 million, about $300 million less than the average rate during the first quarter. Data covering only manufacturing firms show an average accumulation of $500 million per month in April and May, the same rate as in the first quarter of this year.

Some further indication of the course of activity in coming months may be provided by the index of leading indicators. The index rose 1.4 percent in May, the largest increase since last July. Six of the eleven available components advanced, while only three declined. The most important positive factor was the large rise in new orders. While the index is not considered an accurate gauge of future rates of change in economic activity, it is regarded as useful in showing the probable direction of change. The results for May support expectations of further increases in production and purchases.

PERSONAL INCOME, CONSUMER CONFIDENCE, RETAIL SALES, AND RESIDENTIAL CONSTRUCTION

According to preliminary estimates, personal income rose $11 billion in May, equivalent to a 9.8 percent annual growth rate. Total wage and salary disbursements grew at a slightly greater annual rate of 10.3 percent during the month, reflecting a sharp rise in average weekly earnings in the private nonfarm sector. Although part of the May increase was due to the artificially short workweek in April and should be discounted, a substantial part did reflect an improvement in workers' hourly earnings. Over the past year, advances in weekly earnings and in employment have increased total wages and salaries by 10.7 percent. Because inflation has been more moderate, this represents a sizable rise in the purchasing power of workers. Recipients of other types of income have also gained in recent months. For example, proprietors' incomes grew strongly in April and May, reflecting farm owners' higher profits.

Despite the continued advance in personal income, the spring surveys have indicated a weakening of consumer confidence. The Conference Board survey of March-April showed a sharp drop in consumer optimism, compared with the poll two months earlier. After a year of fairly steady improvement, the index dropped 11 points to 82.2 percent of the 1969-70 average level, and an even more significant retrenchment of near-term buying plans was reported at the same time. A later survey by the University
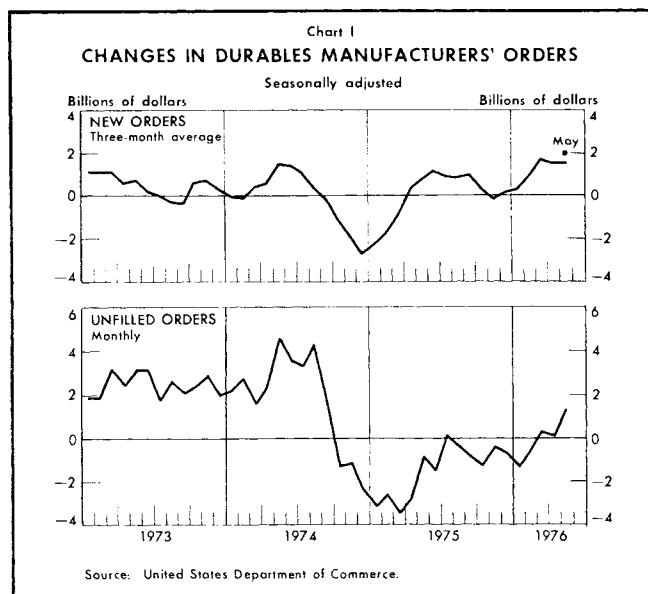
of Michigan, however, suggested a much less pronounced decline in consumer optimism. Any decline at a time when income and employment growth has been strong is surprising. One explanation offered by a few analysts was uncertainty about inflation, perhaps stirred up by recent food price increases. If price increases remain moderate and personal incomes continue to advance, it seems likely that the recent consumer pessimism will recede.
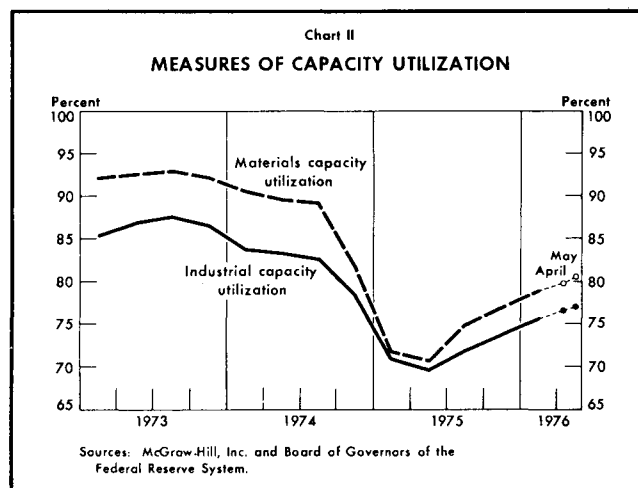
The spring slowdown in retail sales may have reflected the consumers' somewhat less optimistic mood. Seasonally adjusted sales were little changed in April from the March level and fell $1.1 billion in May. However, advance estimates for June showed an increase of $1.4 billion. Domestic-model auto sales also recovered in June, reaching a 9.1 million unit annual rate after a moderate decline in May. Market observers attributed part of the sales increase to price discounts offered on subcompact cars, reflecting auto manufacturers' attempts to reduce swollen inventories before the end of the 1976-model year.

Residential construction activity has been relatively flat this year, although the May data offer some signs of near-term improvement. Permits issued to build new units jumped in May, reaching the highest level in two years, and there was also a slight rise in housing starts. Most of the gain was concentrated in the depressed multifamily sector, where construction had declined in January and February. In May, housing starts of multifamily units increased 12.6 percent and permits issued for new units increased 19.5 percent. While it remains to be seen if the latest pickup in multifamily construction activity presages continued gains, the lower rental vacancy rate and the continued increases in the volume of mortgage commitments at savings and loan associations are conducive to further improvement. Recent news on single-family housing starts has been less favorable than some experts had expected. About half of the decline that occurred between the peak in the third quarter of 1972 and the trough in early 1975 was made up by last December, but there has since been little change.

RESOURCE UTILIZATION AND PRICES

Although the recovery is now into its second year, the bulk of the economy continues to operate well below productive capacity. Most of the measures of capacity use, as well as those of labor market tightness, suggest that output expansion could proceed further in the near term without causing an acceleration in price and wage inflation.

McGraw-Hill reported that output stood at 77 percent of capacity in May (see Chart II). Although up more than 7 percentage points from the trough level, utilization as recorded by this survey is well below the 88 percent

Chart II

MEASURES OF CAPACITY UTILIZATION

Sources: McGraw-Hill, Inc. and Board of Governors of the Federal Reserve System.

level attained in the third quarter of 1973. More interesting to those worried about production bottlenecks is the situation in the industries that produce materials. The Federal Reserve Board has compiled a new index of capacity utilization in the materials industries that provides further insight on this sector. The new index represents a larger share of industrial production than the old major materials series and thus offers a more comprehensive view of cyclical movements in materials utilization.

According to the new index, utilization in May stood at 80.4 percent of capacity, up 10 percentage points from its low point in the second quarter of 1975. The current rate of capacity use appears to be fairly comfortable by historical standards. In the third quarter of 1973, when capacity constraints generated shortages and production delays, this index stood at 93 percent, 13 percentage points above its May 1976 level. Although recent increases in capacity utilization by materials producers have been widespread, they have been somewhat larger in nondurable materials industries, where the resurgence in demand began earlier. Indeed, production facilities are reported by some as being pressed in a few industries, such as paper and textiles, though the pressure appears to be limited to a few product lines and, at least in the near term, should not create severe bottlenecks. Moreover, to the extent that capacity additions are planned in these areas and there are not long delays in the production of capital goods, the possibility of substantial shortages is reduced.

While the capacity utilization data appear encouraging for the price picture, one should not rely too heavily upon

them. Productive capacity is as much an economic as an engineering concept, and the cost of using any particular unit depends on how obsolete it is. If part of existing capacity either is old or reflects outmoded techniques, there may be substantially higher production costs associated with its use, and cost pressures could emerge before utilization reaches historically high levels.

The information on labor market conditions indicates that, despite substantial gains in employment since the onset of the recovery, there are still large numbers of persons available for work. Total civilian employment has risen by 3.1 million in the year since the second quarter of 1975, and 1.1 million of this increase occurred in the second quarter of 1976. Continued growth of the civilian labor force, however, has meant that employment gains have not resulted in equivalent reductions in unemployment. The unemployment rate, one measure of unutilized labor, averaged 7.4 percent in the second quarter, down 0.2 percentage point from its value in the first quarter. Although it is substantially below its peak of 8.7 percent in the second quarter of 1975, the rate is still relatively high. For example, in the 1970-74 period, which included the major part of two recessions, the unemployment rate averaged less than 6 percent.

At current and recent rates of capacity and labor force utilization, many economists would expect a gradual abatement of inflationary pressures. Although the volatile monthly changes do not show this very clearly, comparison of the average rate of price increase thus far in 1976 with that in the last half of 1975 does reveal some easing. For example, consumer prices rose at an average annual rate of 4.2 percent between December and May, while the rate of increase averaged 7.2 percent in the last six months of 1975. A significant deceleration in average hourly earnings (adjusted to exclude interindustry employment shifts and overtime in manufacturing) was also noticeable, as earnings increased at a 6.3 percent annual

rate in the first six months of 1976 as compared with a 7.4 percent rate in the last half of 1975.

Although the average rate of inflation has slowed somewhat, the recent price news has been less favorable than it was earlier in 1976. However, many of the factors that caused the sharp moderation in the winter months, such as gasoline and food price declines, were expected to reverse course and result in an acceleration later in the year. Food prices at the consumer level moved upward in April and posted a further hefty increase in May, causing the overall index to rise at a 7.1 percent annual rate. Excluding food and energy, however, the rate of increase during May was 5.2 percent, consistent with the widespread view on the underlying trend in the inflation rate. Some encouragement could also be found in the behavior of prices of services, such as rent, transportation, medical care, and consumer interest rates. The services component rose at a 5.4 percent annual rate in May, duplicating the moderate rate of April. In the six months prior to April, the average rate of increase had been a rapid 9.7 percent.

The seasonally adjusted wholesale price index rose in June by 0.4 percent, which was somewhat faster than the average increase of the preceding five months. Prices of farm products and processed foods and feeds have added upward pressure to the index since early spring, although in June this component rose less sharply than in the preceding two months. Prices of industrial commodities, on the other hand, rose 0.5 percent in June, which was considerably more rapid than the average rate of increase during the preceding five months. From a longer term perspective, however, the behavior of industrial commodities prices has been relatively favorable. During the first six months of the year, prices of industrial commodities increased at a moderate 3.4 percent annual rate, down substantially from the 9.2 percent rate in the last half of 1975.

The Money and Bond Markets in June

Interest rates in the money and bond markets declined somewhat in June, after increasing in the previous month. With Federal funds trading in a narrow range, rates on money market instruments halted their upward movement and edged slightly back toward lower levels. Bond yields also retraced part of the increases that were registered in May.

The United States Treasury auctioned 24-, 49-, and 61-month notes during June, raising $5.0 billion in new cash. Conversely, at the regular weekly auctions of Treasury bills, net redemptions reduced the amount of short-term debt outstanding. New bond financing in the corporate market was heavy, as firms continued to use bond sales as a major source of financing. Most new issues sold well, although some aggressively priced issues met investor resistance at the month end.
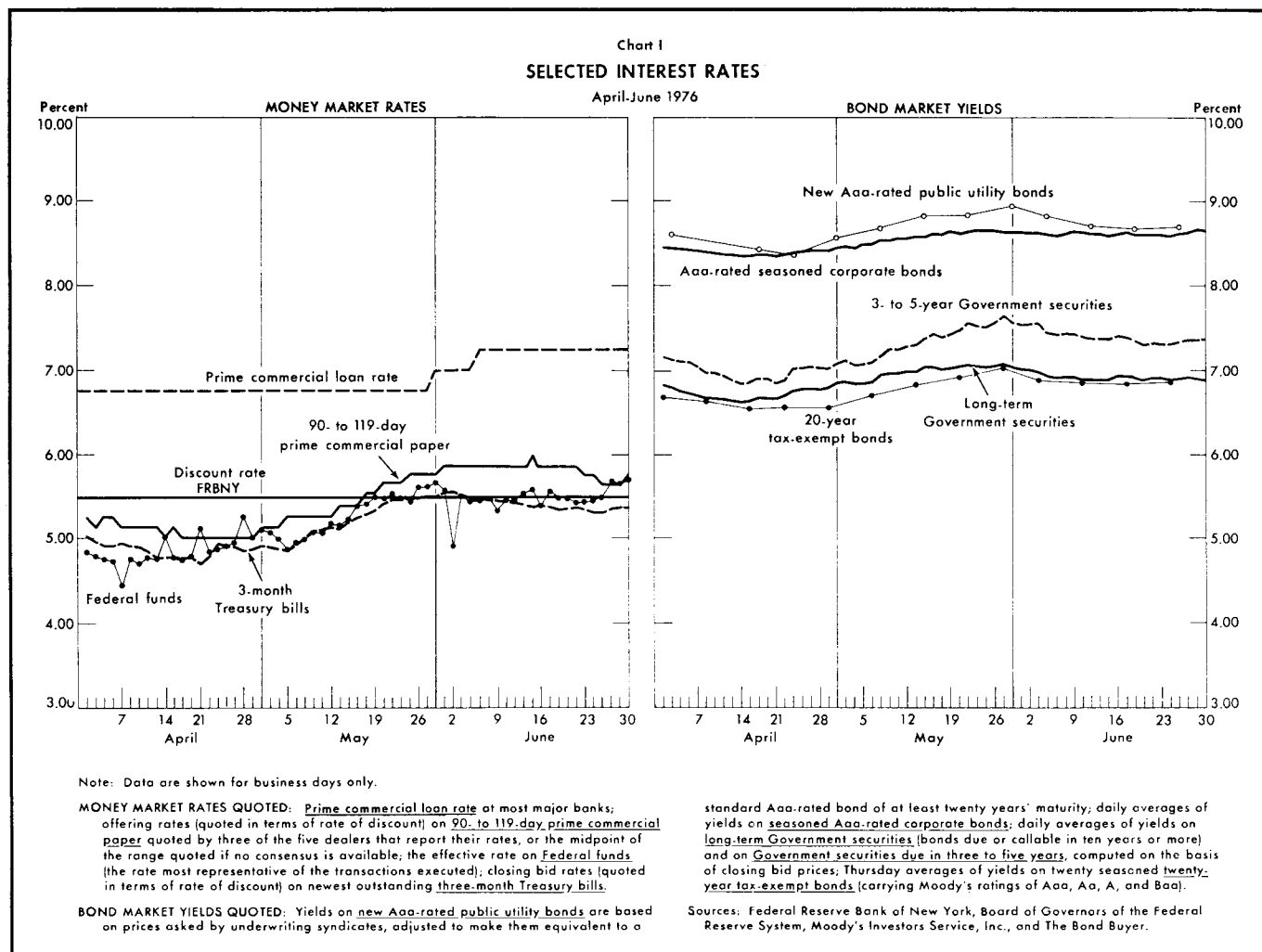
Preliminary data indicate that the narrowly defined money stock (M_1) declined slightly in June after the temporary spurt of late April and early May. Meanwhile, the broadly defined money stock (M_2) grew at a modest pace. In addition, for the first time in 1976, banks increased the volume of outstanding large negotiable certificates of deposit (CDs) during June. This contributed to substantial expansion in the bank credit proxy—total member bank deposits subject to reserve requirements plus certain nondeposit sources of funds—following rather slow growth earlier in the year.

THE MONEY MARKET AND THE MONETARY AGGREGATES

Interest rates on money market instruments declined slightly in June, after having risen sharply since mid-April. Yields on 90- to 119-day commercial paper ended the month at 5.75 percent, nearly unchanged from rates quoted at the opening of the period. Rates on ninety-day bankers' acceptances fell by 23 basis points in June to close the month at 5.68 percent. The average yield in the secondary market on ninety-day CDs declined sharply during the first week of the month but traded at a nearly constant level thereafter to end June at 5.73 percent, down 18 basis points from the rate at the end of May.

The effective rate on Federal funds averaged 5.48 percent in June (see Chart I), an increase of 19 basis points over the average for May but roughly unchanged from the levels of the final week of that month. During June, Federal Reserve open market operations were primarily aimed at offsetting massive shifts in Treasury balances between commercial banks and Federal Reserve Banks. In recent years, the Treasury has been acting to minimize the cash holdings in its Tax and Loan Accounts at commercial banks. The Treasury typically transfers the receipts which flow into these deposits to its accounts at Federal Reserve Banks. These transfers—Treasury calls—drain reserves from the banking system. Conversely, when Treasury expenditures exceed receipts and Treasury balances at Federal Reserve Banks decline, reserves are released to the banking system. The amplitude of fluctuations in Treasury balances at Federal Reserve Banks has increased sharply since 1974, leading to the large impact of Treasury operations on bank reserves reported in Table I. The average absolute weekly impact of Treasury operations on commercial bank reserves was $2.09 billion, computed on a daily average basis, in the first half of this year as compared with only $0.45 billion in the first half of 1973. The effect of these fluctuations on bank reserves can be offset through Federal Reserve open market operations, and Federal Reserve transactions for the System Account have generally mirrored these swings. This activity was particularly heavy in June. The Treasury borrowed funds during the month, which will not be needed until later in the year. In addition, Treasury deposits at Federal Reserve Banks typically rise after midmonth tax dates, such as that of June 15.

In response to the increase in money market rates in May, most banks raised their lending rate to prime customers by ½ percentage point to 7¼ percent during the first half of June. Business loan demand appeared to be starting its long-awaited revival, as loans at weekly reporting banks rose in late May and early June. Data in subsequent weeks did not confirm the stronger loan activity, however. Commercial and industrial loans at all weekly reporting banks, including loans sold to affiliates, declined on a seasonally adjusted basis by $275 million over

Chart I

SELECTED INTEREST RATES

April-June 1976

Note: Data are shown for business days only.

MONEY MARKET RATES QUOTED: Prime commercial loan rate at most major banks;
offering rates (quoted in terms of rate of discount) on 90- to 119-day prime commercial
paper quoted by three of the five dealers that report their rates, or the midpoint of
the range quoted if no consensus is available; the effective rate on Federal funds
(the rate most representative of the transactions executed); closing bid rates (quoted
in terms of rate of discount) on newest outstanding three-month Treasury bills.

BOND MARKET YIELDS QUOTED: Yields on new Aaa-rated public utility bonds are based
on prices asked by underwriting syndicates, adjusted to make them equivalent to a

standard Aaa-rated bond of at least twenty years' maturity; daily averages of
yields on seasoned Aaa-rated corporate bonds; daily averages of yields on
long-term Government securities (bonds due or callable in ten years or more)
and on Government securities due in three to five years, computed on the basis
of closing bid prices; Thursday averages of yields on twenty seasoned twenty-
year tax-exempt bonds (carrying Moody's ratings of Aaa, Aa, A, and Baa).

Sources: Federal Reserve Bank of New York, Board of Governors of the Federal
Reserve System, Moody's Investors Service, Inc., and The Bond Buyer.

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the five statement weeks ended June 30.

Following the temporarily rapid growth rates of the monetary aggregates observed in late April and early May, M_1 declined slightly in June while M_2 posted a modest increase. The pace of monetary growth over longer horizons remained moderate, however. Averaged over the four-week period ended June 30, seasonally adjusted M_1—private demand deposits adjusted plus currency outside banks—increased at an annual rate of 6.3 percent over its four-week average in the period ended thirteen weeks earlier (see Chart II). This brought the M_1 growth rate of 4.0 percent over the four-week average ended fifty-two weeks earlier. Averaged over the four-week period ended June 30, M_2—M_1 plus commercial bank time

and savings deposits other than large negotiable CDs—grew at an annual rate of 9.9 percent over its four-week average ended thirteen weeks earlier and at 9.0 percent over its four-week average ended fifty-two weeks earlier. Combined with member bank deposit growth, the recent increase in CDs pulled the bank credit proxy average to 5.2 percent and 3.2 percent at annual rates over average levels thirteen and fifty-two weeks earlier, respectively.

THE GOVERNMENT SECURITIES MARKET

The Treasury redeemed part of its maturing bills and borrowed new cash through coupon securities during June. This reflected a continuation of its efforts to reduce its

short-term debt and to increase its longer term debt. For example, at auctions held between April 1 and June 30, the Treasury permitted a net $4.4 billion decline in three- and six-month bills while its outstanding debt rose by $0.6 billion.

Treasury bill rates declined somewhat during June, as investors came to believe that further firming in short-term credit markets was unlikely in the near future. At the regular weekly auction on June 28, three- and six-month bills were issued at average rates of 5.37 percent and 5.75 percent, respectively (see Table II), down about 20 basis points below the final auction of the previous month. On June 23, 52-week bills were sold at an average return of 6.08 percent, 23 basis points below the average issuing rate on May 26. Rates on most bill issues ended the month about 10 to 25 basis points below levels prevailing at the end of May.

In the market for coupon-bearing Government obligations, the Treasury borrowed additional funds, totaling $5 billion in three separate note auctions. On June 3, $2 billion of new cash was obtained through 49-month notes at an average issuing yield of 7.71 percent. On June 21, two-year notes with an average return of 6.99 percent were sold to refund $2 billion of maturing notes and to borrow $500 million of new cash. On June 29, an average issuing rate of 7.63 percent resulted from the auction of $2.5 billion of five-year notes for new money.

Some price improvements on seasoned issues were recorded in the Federal agency market, where new issue activity was light. On June 8, the Government National Mortgage Association auctioned $285.5 million of 7¼ percent and 7½ percent mortgage-backed securities for new cash. The thirty-year issues were aggressively priced to yield 8.43 percent and 8.48 percent, respectively, on a corporate bond equivalent basis. On June 23, the Federal National Mortgage Association issued $300 million of ten-year debentures priced at par to yield 7.95 percent. The Farm Credit System placed $1.4 billion of securities on June 17 to raise $292 million in new cash. The issue was composed of $615 million of 6.15 percent Banks for Cooperatives bonds due January 1977 and $789 million of 6.50 percent Federal Intermediate Credit Bank bonds due April 1977. Government-backed tax-exempt urban renewal and public housing notes totaling $580 million were sold through the Department of Housing and Urban Development on June 16. These short-term notes of eighty-six local public housing agencies were placed at an average yield of 3.28 percent, compared with a 3.47 percent rate in a similar offering on May 18.

Table 1

FACTORS TENDING TO INCREASE OR DECREASE MEMBER BANK RESERVES, JUNE 1976

In millions of dollars; (+) denotes increase and (—) decrease in excess reserves

Factors	Changes in daily averages—week ended					Net changes
	June 2	June 9	June 16	June 23	June 30	
"Market" factors						
Member bank required reserves ..	+ 151	+ 165	— 199	— 365	— 562	— 810
Operating transactions (subtotal)	+1,003	+4,859	—2,419	—4,058	—3,214	—3,829
Federal Reserve float	+ 40	+1,040	— 409	+ 8	— 283	+ 396
Treasury operations*	+1,287	+3,845	—1,092	—4,280	—3,434	—3,674
Gold and foreign account	— 44	+ 20	— 6	+ 32	+ 92	+ 94
Currency outside banks	— 162	— 450	— 422	+ 21	+ 586	— 427
Other Federal Reserve liabilities and capital	— 121	+ 407	— 491	+ 162	— 175	— 218
Total "market" factors	+1,154	+5,024	—2,618	—4,423	—3,776	—4,639
Direct Federal Reserve credit transactions						
Open market operations (subtotal)	—1,077	—5,334	+2,865	+3,700	+4,335	+4,489
Outright holdings:						
Treasury securities	— 881	—2,941	+2,580	+2,132	+1,844	+2,734
Bankers' acceptances	— 13	— 12	— 17	— 18	— 17	— 77
Federal agency obligations	— 14	—	— 22	—	—	— 36
Repurchase agreements:						
Treasury securities	— 68	—1,995	+ 276	+1,093	+2,242	+1,548
Bankers' acceptances	— 72	— 292	+ 40	+ 370	+ 210	+ 256
Federal agency obligations	— 29	— 94	+ 8	+ 123	+ 56	+ 64
Member bank borrowings	+ 107	— 149	— 45	+ 116	+ 2	+ 31
Seasonal borrowings†	+ 6	— 5	+ 4	+ 6	+ 7	+ 18
Other Federal Reserve assets‡	+ 55	+ 4	+ 451	— 159	+ 56	+ 407
Total	— 915	—5,479	+3,271	+3,657	+4,393	+4,927
Excess reserves‡§	+ 239	— 455	+ 653	— 766	+ 617	+ 288

	Daily average levels					Monthly averages‖
Member bank:						
Total reserves, including vault cash‡§	33,777	33,155	34,011	33,610	34,789	33,868
Required reserves	33,363	33,198	33,397	33,762	34,324	33,609
Excess reserves§	414	— 43	614	— 152	465	260
Total borrowings	242	93	48	164	166	143
Seasonal borrowings†	17	12	16	22	29	19
Nonborrowed reserves	33,535	33,062	33,963	33,446	34,623	33,726
Net carry-over, excess or deficit (—)¶	56	197	36	220	— 12	99

Note: Because of rounding, figures do not necessarily add to totals.
* Includes changes in Treasury currency and cash.
† Included in total member bank borrowings.
‡ Includes assets denominated in foreign currencies.
§ Adjusted to include waivers of penalties for reserve deficiencies in accordance with the Regulation D change effective November 19, 1975.
‖ Average for five weeks ended June 30, 1976.
¶ Not reflected in data above.

OTHER SECURITIES MARKETS

Yields in the corporate and municipal bond markets also halted the upward movement of the previous month and partly retraced their earlier increases. Sentiment was buoyed by the stabilization in short-term money market conditions. While a substantial volume of new corporate issues, including obligations of many finance companies, was distributed easily during June, aggressive pricing on large issues late in the month met strong investor resistance. After a relatively heavy schedule of new state and local issues through the first half of June, the calendar of tax-exempt financings diminished considerably, taking some pressure off that sector.

In corporate underwriting, the largest industrial offering was $125 million of thirty-year debentures at midmonth. The Aa-rated debt was well received at a yield of 8.57 percent. Mixed receptions were accorded to a number of new utility issues during the month. Investors quickly purchased $200 million of Aaa-rated telephone

Table II
AVERAGE ISSUING RATES
AT REGULAR TREASURY BILL AUCTIONS*

In percent

Maturity	Weekly auction dates—June 1976			
	June 7	June 14	June 21	June 28
Three-month	5.459	5.380	5.356	5.368
Six-month	5.768	5.695	5.722	5.754

	Monthly auction dates—April-June 1976		
	April 29	May 26	June 23
Fifty-two weeks	5.645	6.309	6.081

* Interest rates on bills are quoted in terms of a 360-day year, with the discounts from par as the return on the face amount of the bills payable at maturity. Bond yield equivalents, related to the amount actually invested, would be slightly higher.
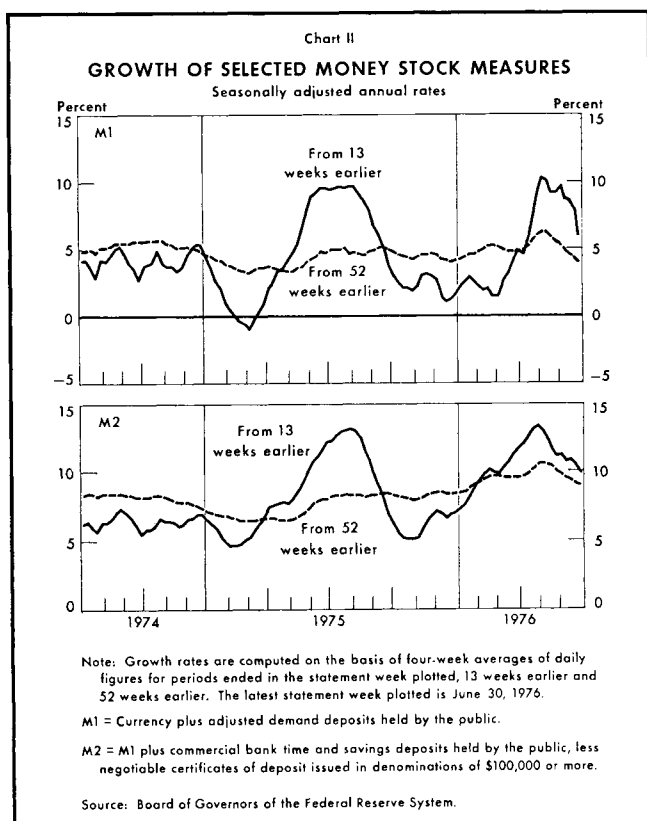
debentures due in forty years at an 8.68 percent yield. However, an Aaa/AA-rated (Moody's/Standard & Poor's) telephone issue met stiff resistance when the $300 million 39-year debentures were priced to return 8.85 percent, a somewhat lower rate than had been expected. The return required on electric utility bonds was indicated by two thirty-year financings during the month. An Aa-rated $80 million issue carried a 9.00 percent yield, while an A-rated $125 million offering provided investors with a 9.22 percent return. In recent months, yield differentials on utilities with different ratings have continued to narrow.

At the beginning of June, the result of increases in municipal rates over the previous month required the State of Maryland to provide yields of from 4.25 percent in 1979 to 6.00 percent in 1991 on $175 million of Aaa-rated securities, 25 to 40 basis points higher than those attached to a comparably rated issue sold a month earlier. Later in June, the State of Wisconsin offered $120 million of Aaa-rated bonds, returning from 3.20 percent in 1977 to 6.00 percent in 2006. These bonds, offered at considerably lower yields on comparable maturities, were successfully distributed after some initial investor resistance. Rate declines over the month were similarly indicated by The Bond Buyer index of twenty bond yields on twenty-year tax-exempt bonds, which closed the month at 6.87 percent, down 16 basis points over the period. The Blue List of dealers' advertised inventories rose by $35 million to close the month at $860 million, reflecting the heavy volume of municipal financing.

Chart II
GROWTH OF SELECTED MONEY STOCK MEASURES
Seasonally adjusted annual rates

Note: Growth rates are computed on the basis of four-week averages of daily figures for periods ended in the statement week plotted, 13 weeks earlier and 52 weeks earlier. The latest statement week plotted is June 30, 1976.

M1 = Currency plus adjusted demand deposits held by the public.

M2 = M1 plus commercial bank time and savings deposits held by the public, less negotiable certificates of deposit issued in denominations of $100,000 or more.

Source: Board of Governors of the Federal Reserve System.

A Probabilistic Approach to Early Warning of Changes in Bank Financial Condition

By LEON KOROBOW, DAVID P. STUHR, AND DANIEL MARTIN*

The subject of early warning is one that challenges our understanding of the nation's financial system. In the perspective of the strains imposed on banks by virulent inflation and severe recession during the past few years, it is clear that improved methods of early detection of financial weaknesses in our banking system could help bank regulatory authorities to anticipate and mitigate future problems. An effective early warning system could make a substantial contribution to a more smoothly functioning financial system.

The Federal Reserve Bank of New York has for some years had under study statistical techniques to assist in the supervision of banks in the Second Federal Reserve District. This research has been aimed at the development of early warning indicators from financial reports that banks file routinely with regulatory agencies. The results thus far strongly suggest that substantial improvements in the allocation of supervisory resources could be achieved by focusing attention primarily on banks designated vulnerable by the criteria set forth in the early warning procedures. These procedures also can provide estimates of the probability that any single bank will, under varying economic circumstances, develop severe financial weakness at some future date. Earlier investigations have been described in the September 1974 and July 1975

issues of the Federal Reserve Bank of New York *Monthly Review*. This article brings those reports up to date and comments more broadly on the role that early warning research can play in improving bank supervision.

EARLY WARNING AS AN AID TO SUPERVISION

The financial turbulence of the 1970's clearly highlighted an important new dimension of the problems of bank supervision. The failure of the United States National Bank of San Diego, the Franklin National Bank, and the Security National Bank dramatized the consequences of high risks and imprudent management, if not fraud, even for large institutions. Each of these banks had assets in excess of $1 billion. While failures on this scale have been relatively few, the general problems that have surfaced in banking in recent years clearly indicate that large banks are not immune to failure and that improved techniques of spotting financial deterioration at an early stage could make an important contribution to the stability of our financial system.

Many of the problems that have affected banks in recent years are the direct result of the twin shocks of severe inflation and recession. In some cases, a willingness to extend the normal limits of risk taking for the sake of enhanced profits during the 1960's and early 1970's contributed to a degree of risk exposure which, in retrospect, proved to be unwise. Clearly, banks must be prepared to take risks if they are to serve the financial needs of the nation's economy, but these risks must be tempered by the public's interest in a sound and stable banking system, since the potential costs of widespread instability in banking extend far beyond the banks directly concerned.

The achievement of an appropriate balance between risk taking and the preservation of comfortable margins of safety with respect to earnings, capital, and liquidity is a goal that both bankers and bank supervisors have a vital stake in pursuing. From this point of view, it is

important to recognize what bank supervisors have always known: that on-site examinations provide accurate insight into developing, as well as actual, financial problems at banks. The experience of supervisors and the results of financial research indicate that financial deterioration typically does not occur overnight. A decline in earnings, capital, liquidity, and asset quality and inadequate management, as reflected in poor internal controls and auditing procedures, usually develop over a period of time. Thus, regularly scheduled bank examinations normally would uncover these adverse developments.

Regular examinations not only probe a bank's financial condition but also provide valuable information on whether banks are complying with regulatory policies and procedures. An on-site examination has strong precautionary and psychological influences on a bank and is the major cutting edge of supervisory policy.

There are, nonetheless, a number of factors that make an effective statistical early warning system important for responsive and efficient bank supervision. First, significant changes in a bank's management policies and financial condition can occur between examinations. Second, an on-site examination is a lengthy and expensive process and not always the most cost-effective method of tracking small, but important, changes in a bank's financial condition. Third, although examiners generally are sensitive to developing trends that indicate potential future management or financial problems and normally comment on such matters in their reports, they must necessarily emphasize their findings concerning the actual condition of the bank rather than the estimated impact of potential problems. Fourth, an examiner's findings are part of the official record and could provide the basis for enforcement or other supervisory actions. In contrast, statistical early warning measures can be informal, affording the opportunity for experiments with techniques to uncover financial weakness at its earliest stages.

In short, early warning analysis can be a valuable adjunct to the process of bank examination and supervision. By providing accurate and timely information on changes in bank financial condition between examinations, it could make possible a more efficient use of supervisory resources. Moreover, an efficient early warning system can be a useful tool of analysis in the ongoing appraisal of bank financial condition.

DETECTING POTENTIAL DETERIORATION

Early warning research at the Federal Reserve Bank of New York has recently focused on the problem of detecting potential financial deterioration in banks rather than on studying the characteristics of banks that have already undergone severe deterioration. This approach required a substantial modification of the methodology employed in the earliest stages of the project.[1]

Measures of vulnerability were investigated, using financial data that are reported routinely to bank regulatory agencies, so that the condition of banks could be closely monitored in periods between scheduled on-site examinations. A number of financial variables were selected for testing. These were variables that past experience had indicated were closely associated with financial strength or weakness. The objective was to find the smallest set of variables that could be used to detect early signs of financial deterioration. Since overall economic conditions can have a substantial impact on a bank's ability to withstand unexpected shocks or strains, the analysis was structured to take into account the external environment.

For each variable employed, a standardized deviation was computed for every bank. The values of the variables were compared with the averages for all member banks in the District, and the differences were divided by the respective standard deviations of each of the variables. The resulting standardized deviations were added algebraically to form an overall bank score in which the component variables were weighted equally. A score was obtained for each member bank from financial data for an appropriate base year. We expected that the higher the bank score the more resistant the institution would be to adverse economic or financial developments while the lower the score the greater its vulnerability.

The performance measure thus obtained for any given base year promised to provide a stable indication of financial strength or weakness for all member banks in the Second Federal Reserve District. The 350 or so member

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[1] See Leon Korobow and David P. Stuhr, "'Toward Early Warning of Changes in Banks' Financial Condition: A Progress Report", *Monthly Review* (Federal Reserve Bank of New York, July 1975), pages 157-65. See also David P. Stuhr and Robert Van Wicklen, "Rating the Financial Condition of Banks: A Statistical Approach to Aid Bank Supervision", *Monthly Review* (Federal Reserve Bank of New York, September 1974), pages 233-38; Joseph F. Sinkey, Jr., and David A. Walker, "Problem Banks: Identification and Characteristics", *Journal of Bank Research* (Bank Administration Institute, Winter 1975); Joseph F. Sinkey, Jr., "A Multivariate Statistical Analysis of the Character of Problem Banks", *The Journal of Finance* (American Finance Association, March 1975); Joseph F. Sinkey, Jr., "Early-Warning System: Some Preliminary Predictions of Problem Commercial Banks", *Proceedings of a Conference on Bank Structure and Competition* (Federal Reserve Bank of Chicago, May 1975), pages 85-91.

banks comprising this group included banks which varied widely in size, scope of banking business, and propensity for taking risks. Among these banks were a large number whose management policies were known to be conservative and whose balance sheets and income statements would lead most observers to conclude that they had a low tolerance for risk. The overall group also included a number of large banks, as well as many that were active practitioners of liability management.

We rejected performance comparisons based on banks that are similar in size and scope of banking activities. The risk exposure in a group of similarly situated banks might be uniformly high or low, and thus be misleading as a basis for determining the degree to which a particular bank might be vulnerable to economic and financial strains.

The scoring approach provides a means for comparing and tracking bank financial performance over varying periods of time. However, one of the main problems in applying these procedures to the supervisory process is the need for a link between the bank scores and an independent measure of a bank's soundness. In other words, it is important to know the significance of a low score and the degree of vulnerability indicated by progressively lower standings in the list of scores.

MEASURING EFFICIENCY

One measure of the effectiveness of the procedures is suggested by the role of the bank score as an aid to bank supervision. That measure is the extent to which the bank scores in a base year provide an accurate indication of those banks that deteriorated seriously in subsequent years, as evidenced by receipt of a low rating from supervisory personnel.

The scoring procedure made it possible to divide Second District member banks into two groups—i.e., resistant and vulnerable. This division suggested that the efficiency of supervision could be improved by allocating resources primarily to the banks designated vulnerable. The dividing line, in terms of bank scores, between the banks designated vulnerable and those designated resistant was drawn with the aid of a cost function that minimized the costs of two types of error—i.e., drawing the line too high and examining more banks than necessary, and drawing the line too low, thus failing to identify banks that were likely to deteriorate or fail.

The cost of the first type of error for a given bank is based on its size, since the cost of examining a large bank usually far exceeds the cost of examining a small bank. The cost of the second type of error is assumed to be a large multiple of the cost of examining the bank and

reflects the high social costs of failing to identify and to examine a bank that subsequently undergoes substantial deterioration.[2] The optimal dividing line between resistant and vulnerable banks is the one that minimized these costs.[3]

The gain in efficiency represents the reduction in examination expenses, less the cost of failing to identify correctly banks that subsequently deteriorated. In this article, the gain is expressed as the percentage reduction in costs from examining only banks designated vulnerable, compared with the costs of examining all banks annually, as at present. In the comparison, total costs are comprised of the costs of the two types of errors described above.

AN EARLY WARNING FUNCTION

Using the cost function, it was possible to compare alternative sets of variables in terms of their value in identifying as vulnerable banks that would be given a low supervisory rating in a subsequent period. The set of variables that yielded the most efficient allocation of supervisory resources was selected after experimentation with many different combinations. The set of six variables discussed below was more efficient than any other combination tested thus far, including the twelve-variable combination employed in the July 1975 report. The six variables are shown in Table I, where the contributions to resistance and vulnerability are indicated by plus and minus signs, respectively.

The first variable, total operating expenses/total operating revenues, is a measure of a bank's ability to generate

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[2] We assumed that the cost of correct classification is zero. This implies that the examination costs associated with designating as vulnerable and, therefore, examining banks that deteriorated seriously is matched by the benefits of identifying the source of, and possibly arresting, the deterioration. See Korobow and Stuhr, *op cit.*, pages 160-63.

[3] The total cost of the two types of errors can be expressed as follows:

$$TC = \sum_{i=1}^{m} (\text{cost } r{:}w)_i + \sum_{j=1}^{n} (\text{cost } v{:}s)_j$$

where:

TC = Total cost

m = Number of banks receiving low summary ratings classified as resistant

(cost r:w)$_i$ = Cost of classifying as resistant the ith bank when it receives a low summary rating

n = Number of banks with high or intermediate summary ratings classified as vulnerable

(cost v:s)$_j$ = Cost of classifying as vulnerable the jth bank when it retains a high or intermediate summary rating

Table I

THE SIX EARLY WARNING VARIABLES

Variable	Sign*
Total operating expenses/total operating revenues	—
Total loans/total assets	—
Commercial and industrial loans/total loans	—
Provision for loss/total loans and investments	—
Net liquid assets/total assets†	+
Gross capital/risk assets‡	+

* A plus sign means that an increase in the value of the variable is indicative of resistance, a minus sign means that an increase in the variable is indicative of vulnerability.

† Net liquid assets are defined as United States Treasury securities maturing in less than one year plus Federal funds sold plus loans to brokers and dealers minus Federal funds purchased minus other liabilities for borrowed money.

‡ Gross capital = Equity capital plus capital notes and debentures plus loss reserves.

Risk assets = Total assets minus cash and due from banks minus United States Treasury securities.

revenues from normal banking operations and to control total expenses in an efficient manner. Operating expenses include all costs except securities losses or extraordinary items. The importance of this variable in relation to various measures of income or rate of return, which had proved less efficient, is that it reflects the limits on bank revenues imposed by market competition. Thus, internal cost control is an especially critical means of maintaining or increasing operating efficiency.

The next two variables—total loans/total assets and commercial and industrial loans/total loans—measure the risk of loss inherent in business lending. The inclusion of both variables is, in effect, a means of emphasizing different aspects of the bank's loan portfolio. Two of the six —provision for loss/total loans and investments and net liquid assets/total assets—are new variables. The former represents a measure of prospective losses envisioned by bank management in relation to the bank's overall loans and investments; the latter measures the bank's ability to meet unexpected deposit or other drains. Finally, the ratio of gross capital/risk assets is a modified version of an earlier measure of bank capital, the main function of which is to cushion losses.

The efficiency of the six variables in classifying banks as resistant or vulnerable is indicated in Table II. Two separate periods are shown: (1) base year 1969, identifying vulnerable banks in 1970-72, and (2) base year 1971, identifying vulnerable banks in 1972-74. In the first period, the inflationary boom in the economy

generated a high level of loan activity and sustained many borrowers whose underlying financial position was not strong. Many banks, therefore, showed good financial results. In the latter period, severe financial strain and recession presented a stringent test of financial staying power for borrowers and lenders alike.

In each estimation period, the calculation to determine the most efficient cutoff score involved the comparison of each bank's score in the base year with its supervisory rating in the subsequent three-year period. A comparison was made of the gains and losses at various cutoff points.[4] At the optimal cutoff point, which gives the highest gain in efficiency, the six-variable early warning function produced a 47 percent increase in efficiency in the 1970-72 period and 42 percent in 1972-74. Moreover, about 87 percent of the banks that received low supervisory ratings in 1970-72 and 93 percent in 1972-74 were correctly identified as vulnerable in the respective base years.

These gains are well in excess of those that could be expected from following several naive decision rules for allocating supervisory resources. For example, Naive forecast 1 in Table II is based on the assumption that bank supervisory ratings will not change over the estimation period. This assumption gives rise to a decision rule that banks with high or intermediate supervisory ratings would not be examined annually. Only low-rated banks in the base year would be subject to annual examinations. This rule yielded a small gain in efficiency in 1970-72 and a substantial loss in 1972-74.

Naive forecast 2 is a broader rule that would exempt from annual on-site examination banks having the highest supervisory ratings. All banks with intermediate or low supervisory ratings in the base year would be examined annually. In this case, the gain in efficiency was much lower than the gain achieved using the optimal decision rule of the early warning function estimated over the period 1970-72 and was negligible over the period 1972-74. Thus, the early warning function developed from the six variables possesses a significantly greater capacity to isolate vulnerable banks than any simple rule based on the tendency of supervisory ratings to remain unchanged over time. The function is also more efficient than the simple assumption that severe deterioration among banks would

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[4] A bank was considered to have had a low supervisory rating if it received a low rating in at least one of the three years subsequent to the base year, although it may not have received a low rating in all three years. In general, approximately three quarters of the banks that received low supervisory ratings during the periods studied had high or intermediate ratings in the base years.

be confined in subsequent periods to those banks with intermediate and low supervisory ratings in any base year. Of course, the value of early warning procedures in improving the efficiency of bank supervision depends on the applicability of the cutoff points, developed from past estimation periods, to the economic conditions expected in the future. Research conducted thus far indicates a good degree of stability.

A PROBABILITY INTERPRETATION OF THE SCORING PROCEDURE

While the division of banks into resistant and vulnerable groups was useful in appraising the efficiency of alternative early warning functions, it made no distinction as to the likelihood that individual banks would deteriorate or fail in each group. A study of the bank scores for various base years indicated that many of the banks at the low range of scores subsequently deteriorated, although some did not, and a few that ranked high did meet difficulty. The outcome owed much to the composition of each bank's loan portfolio, the economic influences affecting the bank's borrowers, as well as its investments, and the capacity of bank management to adjust its financial position quickly and effectively to a changing economic environment. While these factors are reflected in the indicators of financial vulnerability that were employed, it must be emphasized that we are dealing with probabilistic events in the sense that many of the management initiatives that can strongly affect the soundness and future condition of both resistant and vulnerable banks cannot be forecast reliably.

Nonetheless, study of the bank scores and the location in the listing of banks that received low supervisory ratings in the period subsequent to the base year clearly indicates a high concentration of low-rated banks at the bottom of the list. This observation suggests that vulnerability increases with diminished financial performance as measured by the early warning indicators we employed. It also suggests that the bank scores can be translated into a probability estimate using regression methods.

In estimating the probability of banks receiving a low supervisory rating as a function of their scores, we constructed an "observed probability" for each member bank in the Second District. These probabilities were obtained by determining for banks whose scores were within a selected interval in the base year the proportion of banks that received low supervisory ratings over the estimation period subsequent to the base year.[5] That proportion was taken to be a proxy for the given bank's probability of receiving a low supervisory rating. The observed probabilities were then used as the dependent variable of a regression equation.

The purpose of the regression was to estimate the relationship between the bank scores and the observed probabilities. This relationship was assumed to be a continuous function, approaching zero for large positive scores and approaching one for large negative scores. Furthermore, the function was assumed to be monotonic, that

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[5] The interval was one bank score unit on either side of each bank's score.

Table II

ANALYSIS OF GAINS IN EFFICIENCY FROM CLASSIFICATION OF BANKS INTO RESISTANT AND VULNERABLE GROUPS ON THE BASIS OF THE SCORING PROCEDURE

In percent

Cutoff bank score based on:	Base year 1969: estimation period 1970-72		Base year 1971: estimation period 1972-74	
	Percentage of banks having low supervisory ratings correctly identified	Gain in efficiency	Percentage of banks having low supervisory ratings correctly identified	Gain in efficiency
Optimal cutoff point	86.8	47.2	92.9	42.2
Naive forecast: 1*	26.3	11.9	26.8	—75.4
Naive forecast: 2†	89.5	31.7	75.0	7.6

*All banks with low supervisory ratings in the base years of 1969 or 1971 are assumed to retain these ratings in the subsequent three years, with no other banks receiving low ratings.

† All banks with low or intermediate supervisory ratings as of 1969 or 1971 are assumed to be vulnerable in the next three years. Banks with high ratings in 1969 or 1971 are assumed to be resistant.

Table III

ESTIMATED COEFFICIENTS OF THE ARCTANGENT REGRESSIONS

Base year	Estimation period	Coefficients		$\bar{R}^2$
		a_0*	a_1†	
1969	1970-72	−2.7	−.62	.94
1971	1972-74	−1.9	−.60	.91

*Coefficents a_0 are constant terms.
†Coefficients a_1 relate changes in bank scores to changes in probabilities.

is, for any two banks the one with the lower score (meaning that it is more vulnerable) should have a higher probability of receiving a low supervisory rating subsequent to the base year.

A conveniently available trigonometric function having the required properties is:

$$P_i = 0.5 + \frac{1}{\pi} \arctan (a_0 + a_1 S_i),$$

where P_i is the probability that each bank will receive a low supervisory rating, a_0 and a_1 are the coefficients to be estimated from the regression, and S_i is each bank's score. A simple transformation yields an equation that can be estimated using linear regression techniques:

$$\tan (\pi(P_i - 0.5)) = a_0 + a_1 S_i$$

Changes in the value of a_0 shift the curve to the left or right, without changing the function's shape, while a larger absolute value of a_1 increases the steepness of the curve (see chart).[6]

The estimated coefficients of the arctangent regressions for the base year 1969 (estimating probabilities of deteri-

oration in 1970-72) and the base year 1971 (estimating probabilities of deterioration in 1972-74) are shown in Table III. The fit is good in both periods, as indicated by values of $\bar{R}^2$ in excess of .90. While the a_1 coefficients, which relate changes in bank scores to changes in probability, are not significantly different, the constant terms, a_0, do differ significantly between the two base years. The shift appears to reflect overall changes in banking practices as well as differences in the external economic environment during those years. The lower negative value of a_0 in the later period suggests that banks faced a higher risk of deterioration or failure for any given level of bank score as a result of the generally more difficult economic and financial conditions at the time. The chart illustrates the relationship between bank scores and the probability of receiving a low supervisory rating, given the bank scores in the base year 1971 and the supervisory ratings assigned to these banks over the subsequent three years.

The probability function can be related to the earlier efficiency measurement in which banks were designated either as resistant or vulnerable, and supervisory resources were allocated primarily to the vulnerable group. Essentially what was done was to classify as vulnerable all banks whose probability of receiving a low supervisory rating was greater than a certain cutoff probability level. If these optimal cutoff points are translated into the probability of a bank receiving a low supervisory rating subsequent to the base year, then all banks with a probability of about 15 percent or greater would be

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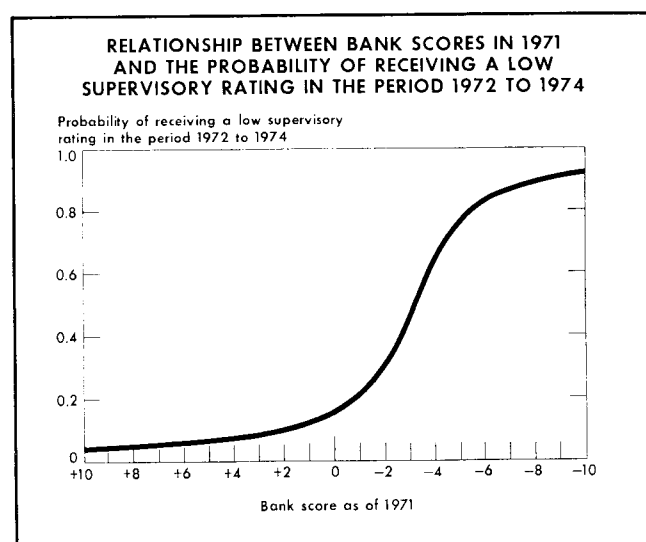
[6] The choice of the arctangent function is arbitrary and was heavily influenced by convenience for programming the regressions. Other estimating procedures are being explored and will be reported on in subsequent papers. Of particular interest is logit analysis, a technique that treats the actual occurrence or non-occurrence of an event as a dependent variable without the construction of observed probabilities. It also dispenses with the intermediate step of combining the independent variables into a single bank score; the relative weights of the variables in the estimated probability function are computed within the regression itself. The technique is described by Strother H. Walker and David Duncan, "Estimation of the Probability of an Event as a Function of Several Independent Variables", *Biometrika* (1967), and is applied to credit analysis in *The Journal of Commercial Bank Lending* (August 1974) by Delton L. Chesser.

RELATIONSHIP BETWEEN BANK SCORES IN 1971 AND THE PROBABILITY OF RECEIVING A LOW SUPERVISORY RATING IN THE PERIOD 1972 TO 1974

Table IV

ANALYSIS OF GAINS IN EFFICIENCY FROM CLASSIFICATION
OF BANKS INTO RESISTANT AND VULNERABLE GROUPS
ON THE BASIS OF VARIOUS PROBABILITY LEVELS

In percent

Cutoff probability level	1970-72		1972-74	
	Percentage of banks having low supervisory ratings correctly identified	Gain in efficiency	Percentage of banks having low supervisory ratings correctly identified	Gain in efficiency
10	94.7	34.3	96.4	14.1
Optimal*	86.8	47.2	92.9	42.2
20	55.3	34.7	75.0	25.6
30	39.5	19.5	58.9	6.6
40	21.1	3.4	41.1	−41.1
50	15.8	3.2	26.8	−74.8
60	13.2	− 1.5	21.4	−89.6
70	5.3	−13.9	16.1	†
80	2.6	−15.9	10.7	†
90	0	−15.6	3.6	†

* For 1970-72 the optimal cutoff probability level was 13 percent; for 1972-74 it was 16 percent.
† Large loss.

considered vulnerable. As shown on Table IV, the efficiency of other specific probability levels can be determined. For example, the first line on the table indicates that, if banks with a 10 percent or higher probability of receiving a low supervisory rating were examined, the gain in efficiency relative to annual examinations would have been 34 percent in the 1970-72 period and 14 percent in 1972-74.

FORECASTING SUPERVISORY RATINGS

The forecasting ability of the early warning function must be tested in periods that extend beyond those used to estimate the function. This test is not yet possible for the function estimated over the 1972-74 period, since the data for a comparable three-year period are not yet available. Nonetheless, we conducted preliminary tests, assuming economic conditions similar to those of 1972-74, and the results are encouraging. The results of one test are shown in Table V. Using the function computed over the period 1971-74, the estimated probability of a bank receiving a low supervisory rating in 1975-77 was obtained for each Second District member bank, based on 1974 financial reports. The banks were classified into five ranges of probabilities. We expected that the proportion

of banks that actually received low supervisory ratings in 1975 would increase as the range of estimated probability increased to higher levels. Table V shows that this is in general what happened, although 1975 represented only one third of the forecast period. Only 2.2 percent of the banks with probability estimates of 20 percent or less received low ratings in 1975, but 41.5 percent of banks with probability estimates of 80 percent or more had low ratings.

Since this test included some banks that had low supervisory ratings not only in 1975, but also in earlier years on which the function was originally estimated, a further test was conducted. In this test, low-rated banks in each probability range were included only if they had received low supervisory ratings for the first time in 1975. These are the banks that, on the basis of a naive decision rule employed in 1974, might have been expected to continue to receive high or intermediate supervisory ratings in 1975. The third column of Table V shows that only 0.7 percent of the banks in the probability range of 20 percent or less received low supervisory ratings for the first time in 1975, compared with 19.5 percent for those with probabilities of over 80 percent. More than half the banks that received low supervisory ratings for the first time in 1975 were in the highest probability range in 1974. This test, while rough and based on the relatively small number of banks that received low supervisory ratings in 1975, suggests that the early warning function has a significant capability for identifying vulnerable banks in years subsequent to the estimation period.

Table V

PERFORMANCE OF AN EARLY WARNING FUNCTION
IN PREDICTING BANKS LIKELY TO RECEIVE
LOW SUPERVISORY RATINGS IN 1975

In percent

Estimated probability of receiving a low rating as of 1974*	Percentage of the banks in various probability ranges as of 1974, which:	
	Had a low supervisory rating in 1975†	Received a low rating for the first time in 1975‡
0 to 20	2.2	0.7
20 to 40	10.2	1.5
40 to 60	17.3	6.9
60 to 80	16.1	6.5
80 to 100	41.5	19.5

* Assumes an economic environment similar to that of 1971-74. Probability estimates are derived from 1974 financial statements of Second District member banks.
† All banks with low supervisory ratings in 1975, regardless of previous ratings.
‡ Banks with low supervisory ratings in 1975 that did not have low ratings in 1974.

CONCLUDING REMARKS

The probability approach shows considerable promise as a useful guide to the degree and intensity of supervision appropriate for banks within an overall group designated vulnerable in any base year. Those banks with relatively high probabilities of deterioration could be considered candidates for the most immediate and intensive supervisory attention. However, to achieve substantial overall gains in efficiency, supervisory resources must also be allocated to banks with relatively low probabilities of deterioration subsequent to the base period. While the precision and efficiency of the forecasts can be expected to improve with more sensitive measures to detect financial weakness at an early stage, some uncertainty is bound to remain in view of the probabilistic nature of financial early warning systems.

New approaches are in process of development. For example, we are exploring methods to estimate the probabilities of failure or a low supervisory rating directly from the early warning variables involved without the intermediate step of the bank score. This change involves a specific weighting of variables and may lead to improvements in the sensitivity of the probability functions. A great deal more must be done to sharpen the measures employed as early warning indicators, thus ensuring that future areas of weakness do not escape unnoticed.

There is also a need in early warning research for a far more thorough analysis of the structure of bank loan portfolios than has been available thus far. In particular, the consequences of industry or geographic concentrations of loans and investments during a period of adverse economic or financial developments are areas that deserve careful study. The balance-sheet and income data which banks are now providing in greater detail and frequency should prove valuable in future early warning research. We are optimistic, however, that the approaches outlined here can do much to assist bank supervisors in spotting potentially vulnerable banks before the problems of these institutions threaten their viability.