JULY/AUGUST 1989

ECONOMIC PERSPECTIVES

A review from the
Federal Reserve Bank
of Chicago

**Banking 1988:
The eye of the storm**

Reconsidering the regional manufacturing indexes

Testing the "spread"

FEDERAL RESERVE BANK
OF CHICAGO

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Banking 1988: The eye of the storm

Profits up, asset quality improved, regional performance better, banking enjoys a spell of calm weather—but will it last?

George Gregorash and Eileen Maloney

After a downbeat 1987, U.S. banks rallied in 1988, posting record earnings and registering return-on-assets (ROA) rates unseen since the 1970s. In large part, the reversal reflected the rebound at the nation's largest banks, where Latin debt provisions had greatly reduced 1987 profits. But, even absent the large-bank recovery, commercial banking profitability in 1988 rose smartly, as lower loan-loss provisions mirrored generally improving asset quality.

These impressive results gave surprisingly little comfort to industry observers, as the year's good earnings news was overshadowed by a nagging array of difficulties and uncertainties in the financial services arena. Foremost among the concerns was the impact of the resolution of current thrift industry problems. The details of the Financial Institution Reform, Recovery, and Enforcement Act remain in negotiation, but the resolution of thrift insolvencies will influence banking both in the short term and well into the future. The immediate task for bankers is to maintain depositor confidence, particularly in the wake of adverse thrift publicity and over 200 bank insolvencies in 1988, while adjusting to the potential real estate market effects of new management of sizable thrift holdings. In the longer term, the issues of redesigned or repriced deposit insurance premiums, altered supervision and regulation, and the conflict between aggressive profit and safe and sound operations leaves bankers and analysts alike wondering, "Who will be our competitors? What will be our powers?" And "How and how much will we pay for safety net privileges?"

Likewise, the granting of limited underwriting powers under Section 20 of the Glass-Steagall Act offered an immediate palliative in the ongoing debate on expanded bank powers, but the ultimate reconciliation of the evolution in financial products with the structure of financial regulation remained elusive. Even under the most desirable expanded-powers scenario for bankers, the stock market break of 1987 and the subsequent slowdown in underwritings served as a reminder of the risks, as well as the opportunities, of the trading/underwriting environment.

On the international scene, both Europe 1992 and the continuing Latin debt situation further complicated the financial services equation. The Europe 1992 initiative added immediacy to the complex issue of national treatment versus reciprocity in international bank powers. Although 1988 bank earnings were not hindered by Latin debt provisioning (unlike 1987), the debt-servicing capacity of certain Latin countries remained a difficult and continuing problem. Add to these, the problems in the Southwest oil patch and other primary commodity-producing areas, leveraged-buyout financings and the continuing

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financial restructuring of corporations, and highly localized but dramatic real estate losses in the eastern U.S. and it is clear that despite strong earnings and stronger balance sheets, the outlook for banking was rich with volatility and uncertainty.

Although most of these issues are not new, and have been much discussed, by the close of 1988 they seemed to have moved from the theoretically challenging to the pressingly real. These issues penetrate deep into the heart of contemporary finance. But for the record books, the scorecard for banking in 1988 was an enviable one that recalled simpler days.

Profits rebound

The ROA for U.S. banks in 1988 was 0.87 percent of average assets, a considerable improvement over the 0.13 percent reported in 1987, the lowest ROA since the Depression era. And, except for 1985, 1988 was also the first time in the last ten years that U.S. ROA rates increased over the prior year. (See Figure 1.) Further, the distribution of U.S. earnings rates narrowed, reflecting fewer unprofitable firms. (See Figure 2.) In 1988, approximately 13.5 percent of U.S. banks lost money, compared with 18 percent in 1987. The bulk of the decline in unprofitable banks came from the Midwest and the Southwest, where the number of banks losing money, relative to the U.S. total, dropped 56 percent and 35 percent respectively compared with 1987.

At yearend 1988, the U.S. had 12,792 banks with total assets of $3.1 trillion. Most of the banks (97 percent) are community banks with less than $1 billion in assets. The 349 banks over $1 billion made up 3 percent of all U.S. banks, but they held 69 percent of total banking assets. Consequently, the largest banks in the country have a disproportionate effect on the aggregate performance of the industry. This is best demonstrated in the 1988 reported ROAs.

Sectoral improvement

While large-bank performance had the greatest impact on aggregate measures, earnings improvements were spread across all size groups and sectors. All regions' ROAs rebounded from 1987 and most also surpassed their 1986 levels (which did not reflect LDC provisioning). (See Figures 3 and 4.) The strongest rebound was in the West where both provisions and high noninterest expenses declined. ROA rates in the West went from 0.35 percent in 1986, to –0.05 percent in 1987 to 0.91 percent in 1988. The Southwest also showed signs of moderating stress. While the composite Southwest region continued to register losses, the rate of decline slowed. The Southwest region ROA remained in the negative range at –0.66 percent in 1988 compared with –0.83 percent in 1987 and –0.41 percent in 1986. The number of unprofitable firms in the Southwest declined from 1987 although more than 30 percent of these banks still have negative earnings. In both 1987 and 1988, the unprofitable Southwest banks accounted for a third of U.S. banks with losses.

FIGURE 1

Return on assets — all U.S. commercial banks

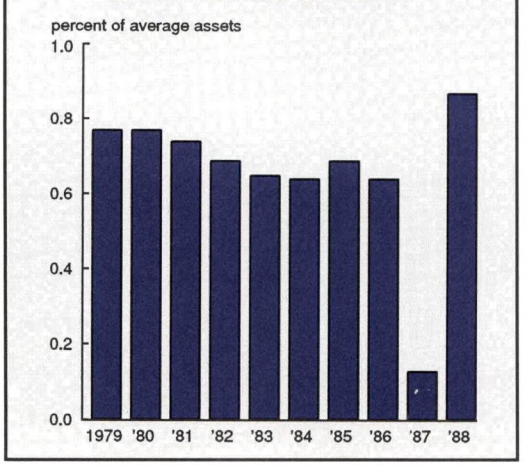


FIGURE 2

Return on assets — by number of banks

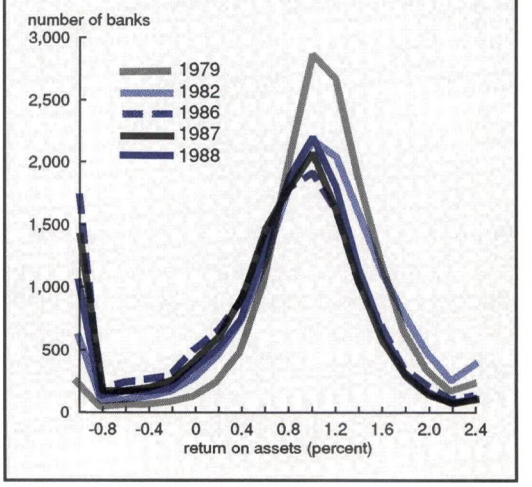
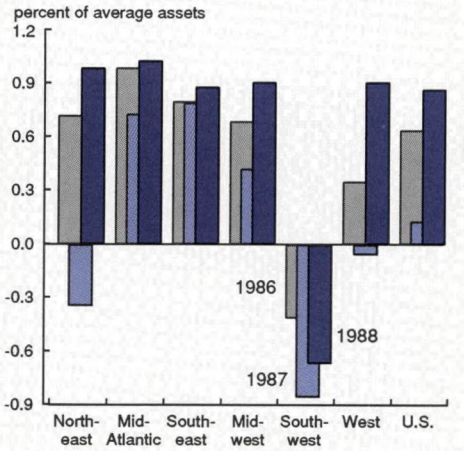


FIGURE 3

Return on assets — by region



Asset quality improves

Reductions in provisions set aside for problem loans drove the earnings improvement. U.S. provisions declined to 0.49 percent of average assets in 1988 from 1.24 percent in 1987. The drop in loan-loss provisions was consistent with the steadily declining levels of nonperforming assets. (See Figures 5 and 6.) Nonperforming assets for the U.S. totalled 2.12 percent of total assets, down from 2.46 percent in 1987. This reversed the increase experienced by the large banks in 1987, reflecting Latin debt nonaccruals. Nonperforming assets to total assets declined for all regions of the country in 1988, with the exception of the Northeast. Its ratio increased marginally to 2.84 percent from 2.81 percent in 1987 because of slight increases in nonperforming real estate and individual loans.

With roughly stable net charge-offs, lower loan-loss provision levels, and growing loan portfolios, the U.S. loan-loss reserves relative to total loans declined in 1988 to 2.39 percent from 2.70 percent in 1987. But as nonperforming levels also declined, the U.S. coverage ratio of loan-loss reserves to nonperforming loans actually rose in 1988 to 83 percent versus 79 percent in 1987 and 60 percent in 1986. This was true for all regions except the Northeast where the coverage ratio dropped to 72 percent from 79 percent in 1987.

While total U.S. assets grew 3.7 percent in 1988, that is not the cause for the decline in the nonperforming-assets-to-total-assets ratio—merely a contributing factor. The dollar value of nonperforming assets declined over

FIGURE 4

Regions in the U.S.

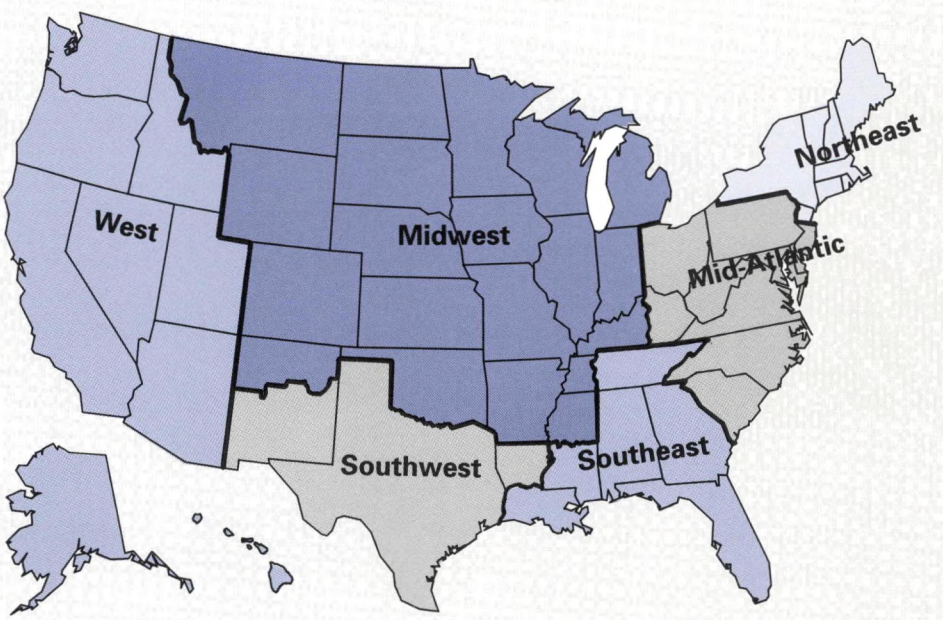


FIGURE 5

Provisions — by region

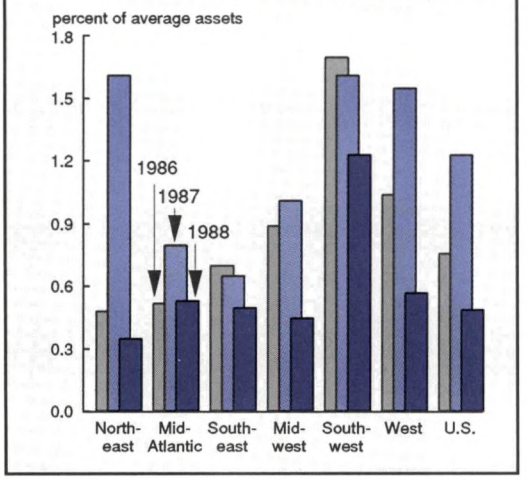
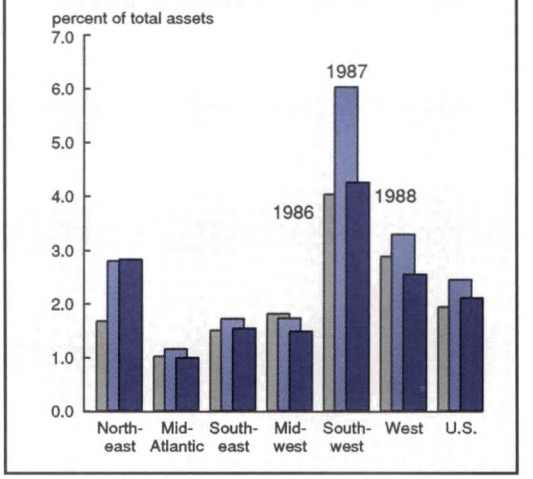


FIGURE 6

Nonperforming assets — by region



the year from $72.2 billion in 1987 to $64.6 billion in 1988 as a result of LDC restructuring and charge-offs and general improvement in loan portfolios across the country. The bulk of the decline in nonperforming assets came from nonperforming loans although other real estate owned also declined for all size groups and all regions with the exception of the Northeast and the West. Barring any economic downturn, the downward trend of nonperforming assets should continue as sectoral weaknesses continue to improve.

Delinquent loans, 30-89 days past due, were stable in 1988 for the nation. However, this was true only as a percent of loans, not in terms of dollar value. Delinquent loans totalled $31.2 billion in 1987 compared with $31.6 billion in 1988. But because the U.S. loan growth was 5.1 percent in 1988, the ratio remained the same, year to year. Real estate delinquencies were up in all regions with the exception of the Midwest and the Southwest. The Southwest region's total delinquent loans moved from 2.97 percent of loans in 1987 to 2.18 percent in 1988. In contrast, the Northeast region exhibited an increase with total delinquencies moving from 1.31 percent of loans to 1.61 percent in 1988 as real estate loan delinquencies increased 66 percent.

Declining dollar levels of nonperforming assets were part of improved balance sheet positions of banks. Growing capital levels were also a factor. With the exception of the Southwest region, all sizes and sectors of U.S. banks showed improvement in capital from 1987. For the U.S. as a whole, tangible primary capital grew to 7.78 percent of tangible assets in 1988 from 7.67 percent a year ago. Unlike in 1987, capital growth in 1988 was not the result of increased loan-loss reserves but rather higher income retention and equity financings.

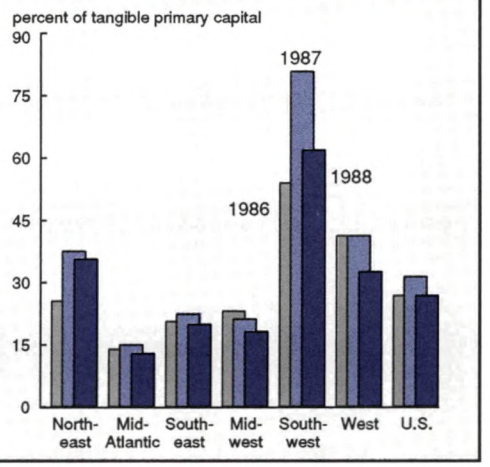
On a national level, then, the proportion of tangible primary capital encumbered by nonperforming assets declined to 26.82 percent in 1988 from 31.44 percent in 1987. However, the decline in the ratio was brought about primarily by the large banks. As with ROA, the Southwest region showed improvement with nonperforming assets moving to 62.08 percent of tangible primary capital from 79.54 percent in 1987. (See Figure 7.)

Stronger cost control

The issue of rising overhead costs relative to assets is one that transcends economic cycles. The cost of doing business has been steadily rising over the past decade as the banking environment has rapidly evolved. As competition in the industry increased from interest rate deregulation, interstate banking, and expanded bank powers, the pressure to control costs and increase the bottom line has also grown. Over the past two years, many headlines announced cost-cutting measures within the banking industry. The increased emphasis on cost containment and the focus on improving efficiency appears to have begun

FIGURE 7

Nonperforming assets — by region



paying off for U.S. banks in that overhead costs did not rise in 1988 but remained constant since last year at 3.25 percent of average assets, but still up from the 3.02 percent reported in 1984.

A large-bank perspective

Although 1988 was an improving year for all size groups of banks, improvement was most pronounced at the large U.S. banks, i.e., those over $10 billion in assets, reflecting reduced LDC provisions. Their 1988 ROA soared to 0.95 percent of average assets from –0.67 percent in 1987. (See Figure 8.) This positive performance was reflected not only in their financial statements but also by the stock market as their stock prices rebounded. (See box.)

Banking 1988: A market view

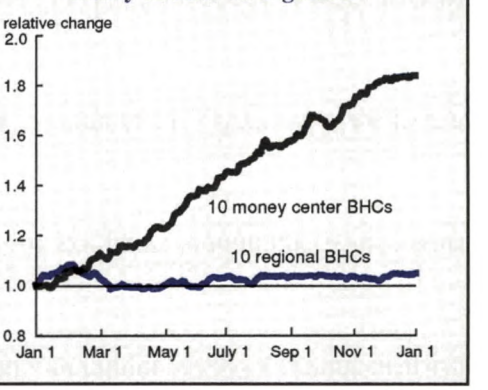
Money center bank stocks performed impressively during 1988, rebounding from a lackluster performance during the prior year. Concerns about the LDC debt problem, domestic asset quality, and low relative capital levels abated during the year as money center banks began reaping the benefits from actions taken to address these concerns.

By using Ordinary Least Squares regression, the performance of individual firm share values can be evaluated relative to the market (S&P 500) and the rest of the financial industry (NYSE Financial Index). That is, the effects of the changes in the market's perception of the individual firms are separated from the effects of the changes in the market's perception of the value of the stock market as a whole and of the value of the financial industry (finance, insurance, and real estate) specifically. Thus, the model produces a return adjusted for market risk and industry risk.

The model uses actual firm and market returns (change in the firm's stock price, adjusted for dividends and stock splits) for 1987 to determine the relationships between the firm and market returns and the firm and industry returns. These values are then used to calculate the expected daily return in 1988, given the S&P 500 and the NYSE Financial Index return. This expected return is then compared to the observed return to determine the deviation of the actual performance from the expected levels. These deviations are then cumulatively summed over the year to show risk-adjusted performance over time. Average performance is then calculated for money center banks and regional banks by selecting ten banks from each group, summing the performances of each bank in the group, and dividing the result by ten.

The average performance of the share values of the ten money center banks increased consistently throughout the year relative to the market and the industry. Although a few money center banks enjoyed returns of well over 50 percent from depressed 1987 levels, their large gains

Risk-adjusted BHC portfolio performance — money centers vs. regionals



Improvement was also the case for the large banks in the Seventh Federal Reserve District whose ROA went from –1.47 percent in 1987 to 0.86 percent in 1988. The Seventh District, which consists of parts of Illinois, Indiana, Michigan, Wisconsin and all of Iowa, has 18 percent of all U.S. banks and 12 percent of U.S. assets. The District consists primarily of community banks (2,323) although 32 banks with more than $1 billion in assets account for 48 percent of District assets. The disproportionate effect of large banks on aggregate performance measures noted earlier was also true for the District, though the effect was not as evident as it is in the U.S.

In addition to declining provision levels, net interest margins for U.S. large banks improved to 3.04 percent of average assets in 1988 from 2.86 percent in 1987. Improved margins were generally attributable to better interest yields and the recognition of Brazilian interest payments. Despite the fact that most banks recognized the income, the Brazilian loans remain in nonperforming status. Under current financial reporting requirements, income on the Brazilian loans will be recognized only to the extent of cash received until a period of payment performance by the Brazilian government has been established. While not readily apparent in the ratios, large bank margins were adversely affected in 1988 as Argentine loans went into nonperforming status.

accounted for only part of the increase in the average. Individual plots of eight of the ten firms included in the sample resulted in curves that were similar in shape and direction to the one shown.

Several factors contributed to this impressive performance. The market apparently downgraded its perception of the LDC situation from crisis to problem proportions as money center banks increased loan-loss reserves during 1987 to reflect more conservatively the value of these loans. Several money center banks also decreased their LDC exposure either by outright loan sales or some other form of restructuring. The substantial reduction in loan-loss provisions in 1988, combined with the results of cost containment measures initiated during the past two years and an increase in noninterest income resulted in substantially higher profits during 1988. This increase in income led to improved capital ratios (i.e., total equity to total assets) at nearly all of the money center banks examined as well as increased dividend payouts at several banks. Still another factor that contributed to impressive stock price performance by money center banks in 1988 was an improvement in asset quality reflected by drops in both non-LDC nonperforming loans and non-LDC charge-offs. In addition, recent underwriting powers granted by the Federal Reserve as well as further development of investment banking activities may have contributed to increased optimism among investors.

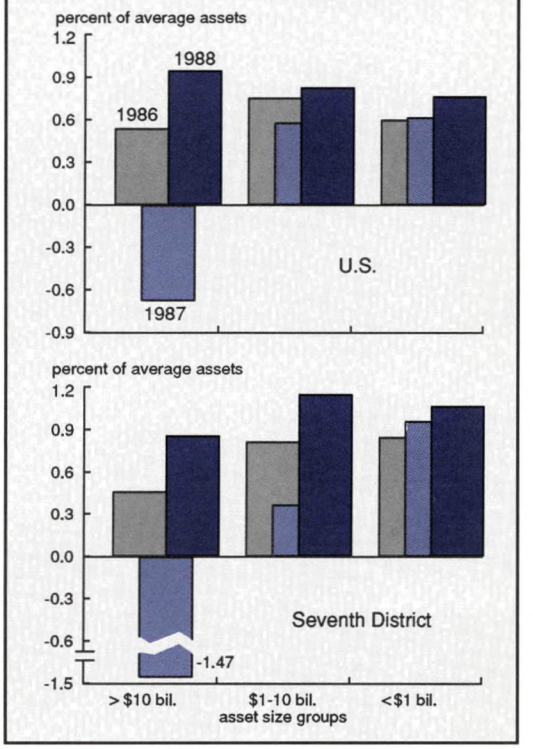
The portfolio of large regional bank stocks did not fare as well as the money center banks during 1988. As shown by the graph, the risk-adjusted return of the ten money center banks exceeded the risk-adjusted return of the ten regional firms. However, within the group of ten regional banks, there was significant disparity in performance. Some regional bank firms experienced deteriorating fundamentals due to management changes, credit quality concerns, merger difficulties, as well as various other problems, while others continued their stellar performance of previous years.

The impressive performance of regional banks in 1987 actually contributed to the disparity between the two lines shown in the graph. Regional bank stocks were already highly valued by the market by the end of 1987. Thus a relatively flat performance in 1988 by regionals should not be viewed too negatively in light of their strong 1987 performance. In contrast, money center bank stocks performed poorly in 1987. The positively sloped line for money centers indicates improved performance relative to the prior year.

—Philip M. Nussbaum

FIGURE 8

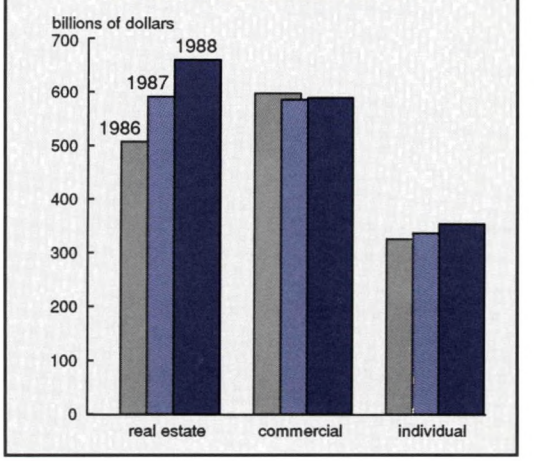
Return on assets — by asset size



Given the rising margins, one might look more closely at the loan portfolio. In 1988, large banks' total loans accounted for 37 percent of the U.S. loan portfolio. Within the U.S. loan portfolio distribution, commercial loans have been displaced by real estate loans as the largest portion of the total portfolio. (See Figure 9.) Given the weakness in various real estate markets across the country and the increase in real estate loan delinquencies, this could be an alarming trend. But, one must also consider the changing activities of the large banks in the United States. Large banks are not booking as many commercial loans, because their corporate customers can issue their own commercial paper to raise needed funds. And, securitization of loans allows banks to book loans and then package and sell them to increase fee income.

FIGURE 9

Loan portfolio distribution — all U.S. commercial banks



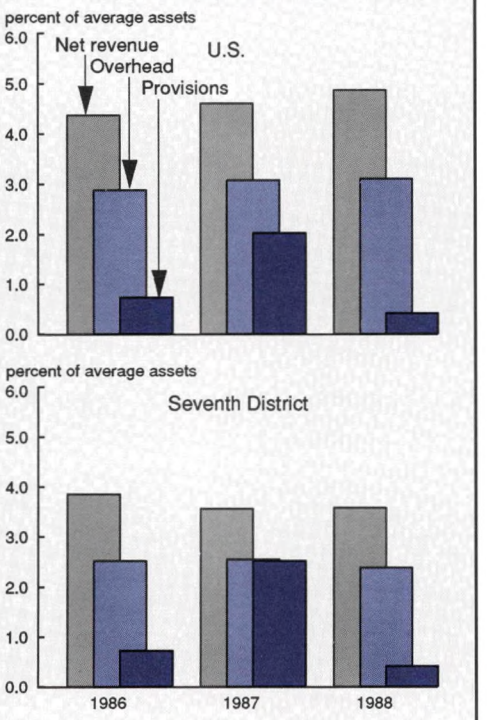
Increased noninterest income also aided large-bank revenues. Technological advances have led to increases in and greater dependence on noninterest income as increased competition has cut banks' income from traditional banking activities. Total noninterest income for District large banks was 1.43 percent of average assets compared to 1.29 percent in 1987. Income from foreign exchange continued to be a major contributor to the earnings of District large banks and accounted for 0.21 percent of average assets for 1988 compared to 0.18 percent in 1987. The bulk of the increase in noninterest income, however, comes from the "other" category which includes the sale of buildings, pension reversals, and other discretionary income items. It appears that this category has become increasingly important to the large banks. The noninterest "other" category for District large banks grew to 0.80 percent from 0.75 percent of average assets in 1987. Total noninterest income for U.S. large banks was 1.85 percent in 1988, up from 1.77 percent in 1987. The "other" category for these banks grew from 1.07 percent in 1987 to 1.10 percent in 1988.

In addition to generating additional revenues to improve the bottom line, large banks also benefitted from increased overhead cost control. District large banks showed substantial improvement with overhead costs dropping to 2.41 percent of average assets from 2.57 percent a year ago. The overhead costs for U.S. large banks rose very marginally to 3.12 percent from 3.10 percent a year ago. (See Figure 10.)

Nonperforming asset levels have declined. District large banks reported nonperforming assets of 2.11 percent of total assets, down from 2.26 percent in 1987. The higher ratio in 1987 was caused by LDC exposures, especially Brazilian loans. District large banks

FIGURE 10

Earnings analysis — banks with over $10 billion in assets



also reported a 1988 increase in net charge-offs to 1.17 percent of total loans (versus 0.96 percent in 1987), attributable to charge-offs made against LDC loans. Similar trends were seen nationally. Nonperforming assets as a percent of total assets for U.S. large banks declined to 3.02 percent from 3.55 percent in 1987. This represents a substantial decline despite the Argentine nonaccruals in 1988. And, net charge-offs rose to 1.08 percent of total loans from 0.89 percent in 1987.

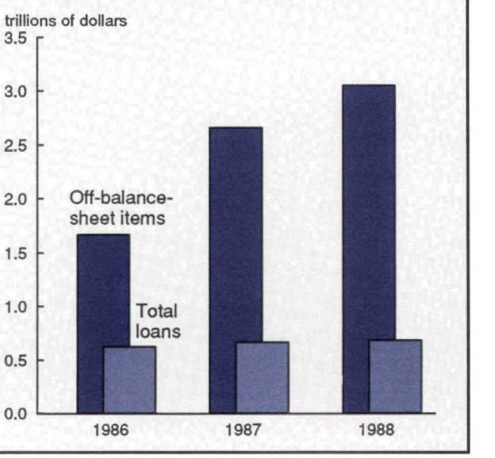
An ongoing issue, particularly for the large banks, will be the ability to resolve the LDC concerns without significant additional charge-offs. The Brady Plan envisions resolving each LDC debt problem with a customized plan of forgiveness, interest abatement, and new money loaned on some form of collateralized basis. The economic and political uncertainties of some of these countries presents a continuing adverse environment for either short- or long-term solutions.

Despite the decline in loan-loss reserves as a result of decreased provision levels and stable net charge-offs, tangible primary capital levels grew in 1988. Like ROA ratios, most of the growth in capital was attributed to the large U.S. banks, whose tangible-primary-capital-to-tangible-assets ratio grew to 7.66 percent from 7.39 percent in 1987. With record earnings, the large U.S. banks contributed to capital levels by increasing the amount of income retained in 1988 to 61 percent of income, up from 56 percent in 1986 and from 1987 when this size group had negative earnings (although they still paid dividends). As did large U.S. banks, District large banks also retained a larger share of income in 1988 (72 percent) versus 1987, causing tangible primary capital to increase to 7.83 percent of tangible assets from 7.20 percent in 1987.

These measures of capital adequacy, however, only take into account the assets on banks' books. Off-balance-sheet items such as loan commitments, standby letters of credit, foreign exchange contracts, and interest rate swaps, through which much of the large banks' noninterest income is generated, will also be considered for risk-based capital ratios being implemented from 1990 to 1992. As these items are growing rapidly, it is appropriate that tangible-primary-capital ratios are also increasing. (See Figure 11.) At yearend 1988, District off-balance-sheet items were 81 percent of total assets compared to 66 percent in 1987. Comparative totals for the U.S. were 112 percent in 1988 and 101 percent in 1987. For District large banks, these ratios are considerably higher at 295 percent of total assets for 1988 and 220 percent for 1987. Likewise, U.S. large banks had off-balance-sheet items

FIGURE 11

Off-balance-sheet items and total loans — banks with over $10 billion in assets



equalling 273 percent of total assets in 1988 compared to 246 percent in 1987. Off-balance-sheet items for the large banks in the New York Federal Reserve District were 391 percent of total assets in 1988, up from 337 percent in 1987. If these items were to be included as assets on the balance sheet, the effect would be to reduce risk-adjusted returns far more substantially.

Smaller banks

Although the improvement in bank earnings was driven principally by the large banks, other size groups also reflected improvement. Banks in the $1-to-$10-billion-asset category reflected the trends seen in the largest U.S. banks. ROA rates improved in 1988 to 0.83 percent from 0.58 percent in 1987 when LDC provisions negatively influenced earnings. Noninterest income also rose 5 basis points to 1.49 percent of average assets in 1988. Asset quality also improved in 1988 as nonperforming assets to total assets declined to 1.47 percent from 1.71 percent in 1987. This also bodes well for the future because regional and super-regional banks were more aggressive than money center banks in eliminating LDC risk from their portfolios. This reduction was accomplished through loan sales, charge-offs, and debt-for-equity swaps.

The smaller community banks, under $1 billion in assets, continued the trend of improved ROAs, moving to 0.77 percent from 0.63 percent in 1987. Noninterest income and net interest margins were fairly stable from 1987 at 0.89 percent and 4.07 percent of average assets, respectively.

The rise in 1988 profitability for smaller banks came from two sources. As with the rest of the industry, loan-loss provisions declined to 0.48 percent of average assets from 0.64 percent in 1987 reflecting improved loan portfolios. As different regional economies improved around the country, loan demand, led by real estate, increased. The same trend in loan distribution was seen in smaller banks as commercial loans were surpassed by real estate loans. While these trends are explainable in large banks, they are perhaps more noteworthy in the smaller ones.

The other factor that contributed to improved profitability was lower overhead costs. The overhead-to-average-assets ratio declined to 3.27 percent from 3.30 percent in 1987. Given the amount of workouts with problem loans, the fact that overhead declined at all should be considered a major accomplishment by these banks.

The drop in provisions for these smaller banks was borne out by a drop in nonperforming assets from $18.4 billion to $16.2 billion in 1988. The nonperforming-assets-to-total-assets ratio fell from 1.91 percent in 1987 to 1.71 percent in 1988. Asset quality was better with respect to capital, also, as 19.65 percent of tangible primary capital was encumbered by nonperforming assets versus 22.18 percent last year.

Ag banking strong despite drought

The Midwestern region of the country encompasses the Chicago, St. Louis, Minneapolis, and Kansas City Federal Reserve Districts. The region's 7,134 banks account for 56 percent of the nation's banks and 23 percent of the assets. The region also includes the majority of agricultural (ag) banks in the country which are generally small in size. In 1988, there were 1,635 ag banks in the region; these accounted for nearly 13 percent of all U.S. banks but only 1.3 percent of total banking assets. For the purposes of this article, we define ag banks as those having more than 30 percent of their loan portfolio consisting of agricultural loans.

Midwestern ag areas, benefitting from government subsidies and higher prices obtained for available inventories, continued the improvement begun in 1987. Despite severe drought in parts of the Midwest, agricultural banks continued their regeneration from the lean times of the early 1980s. The Midwestern ag banks reported a 1988 ROA of 0.94 percent of average assets versus 0.65 percent in 1987, and a substantial increase from the 0.29 percent reported in 1986. These ROAs have not yet reached the levels of the early 1980s, but they are a marked improvement from the mid-1980 levels. This recovery is even more significant when compared with the Midwestern non-ag banks' ROAs of 0.91 percent, 0.41 percent and 0.71 percent for 1988, 1987 and 1986, respectively. (See Figure 12.) Once again, the driving factor behind earnings was the decline in loan-loss provisions to 0.37 percent of average assets in 1988 from a high of 1.59 percent in 1985.

FIGURE 12

Return on assets — Districts 7–8–9–10

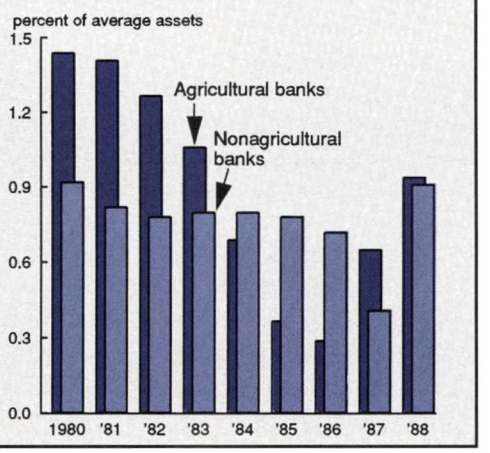
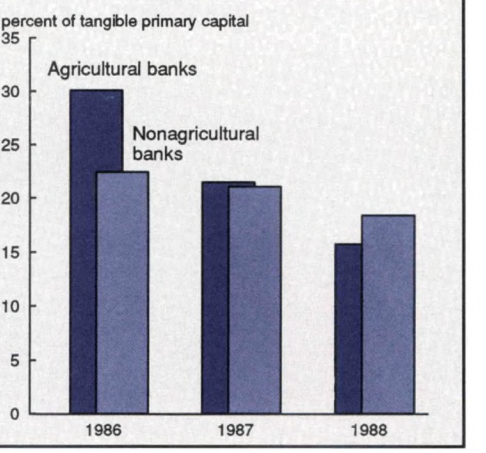


FIGURE 13

Nonperforming assets — Districts 7–8–9–10



The drop in provisions was backed up by a similar decline in nonperforming loans to total loans to 2.45 percent in 1988 from 3.53 percent in 1987 and from a high of 5.50 percent in 1985. Further, the coverage ratio (loan-loss reserves to nonperforming loans) for these ag banks was 94 percent for 1988, up from 67 percent in 1987.

Asset quality with respect to capitalization looked even stronger. Nonperforming assets to tangible primary capital fell from 21.53 percent in 1987 to 15.81 percent in 1988. The ag banks' ratio is now lower than the non-ag banks in the region, which reported 18.49 percent this year compared to 21.13 percent last year. (See Figure 13.) This can be attributed to one of the ag banks' traditional strengths—strong capitalization despite some very dark times. Tangible primary capital for these banks grew to 10.60 percent of tangible assets in 1988, up from 10.21 percent in 1987. This far exceeds the 7.99 percent reported by non-ag banks in the region in 1988.

Performance in 1989 will be dependent on whether the drought conditions of 1988 are repeated in the new year. The current forecasts for 1989 are still guarded. Based on the 1988 ratios, it would appear that the drought did not seriously affect farmers, or their bankers, in 1988. However, concerns remain over the current level of subsoil moisture and the ability to continue to recover should dry conditions prevail for another year.

Seventh District

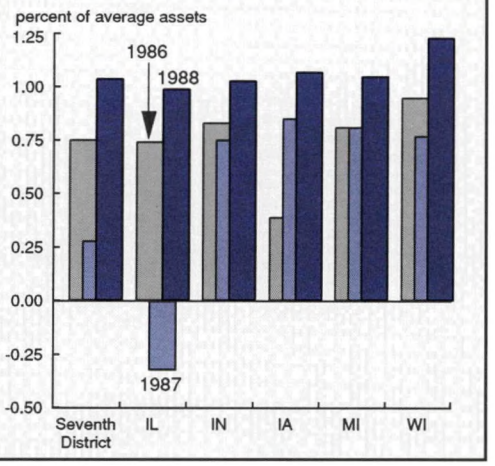
Seventh District banks shared in 1988's bounty, with particularly strong gains recorded by community banks. A stronger industrial economy buoyed many District banking firms. In the early years of the current economic recovery period, the Seventh District did not share in the national recovery and was in fact adversely affected by both the poorly performing agricultural and manufacturing sectors. Now, as economic improvement continued, banks in these sectors demonstrated stronger performance.

In fact, since 1986, Seventh District banks outperformed the U.S. as a whole. The Seventh District's 1988 ROA of 1.04 percent easily surpassed the District's prior decade high set in 1979. (See Figure 14.) Further, fewer banks registered losses or low earnings rates. This was partially offset by fewer banks earning extremely high returns. The number of banks with losses in the Seventh District fell from 173 in 1987 to 82 in 1988. (See Figure 15.) The biggest decline in the number of banks with losses was in Iowa which fell from 60 banks to 20 in 1988, as compared with 165 in 1986.

The District ag banks reported a 1988 ROA of 1.08 percent of average assets compared with 0.76 percent and 0.32 percent in 1987 and 1986, respectively. Nearly 70 percent of these ag banks are located in Iowa; their ROA has improved to 1.06 percent from 0.85 percent in 1987 and 0.38 percent in 1986.

FIGURE 14

Return on assets — Seventh District

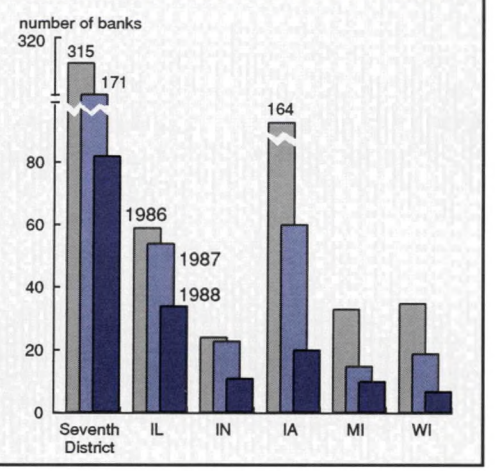


As in the rest of the nation, reduced provision levels resulted in higher ROAs. Notably, Iowa banks had the highest provision levels of the states in the District in 1986 with 1.17 percent; in 1988 they had the lowest with 0.24 percent of assets.

In addition to lower provisions, overhead cost control has also contributed to an improved bottom line. In 1984, overhead expenses for District banks were 2.82 percent of average assets and they rose steadily through 1986. The incremental upward spiral of the past several years reversed in 1987 as District overhead expenses declined to 2.95 percent from 2.97 percent in 1986. District overhead expenses improved further in 1988 to 2.91 percent of average assets.

FIGURE 15

Banks with net losses — Seventh District

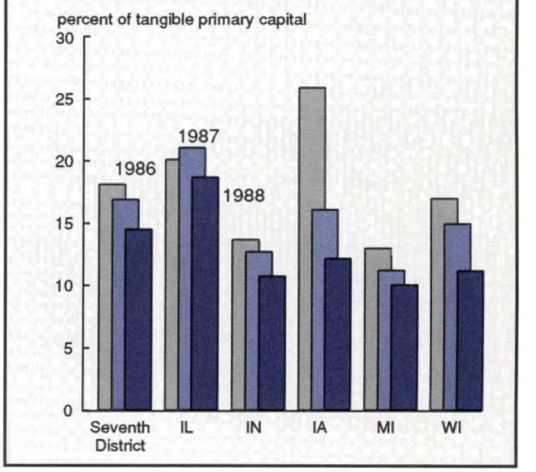


As with most of the nation, District nonperforming assets improved from 1.33 percent of total assets in 1987 to 1.16 percent in 1988. Reduced provision levels coupled with stable loan net charge-offs, caused the District loan-loss reserve levels to decline to 2.23 percent of loans in 1988 from 2.58 percent in 1987. However, as nonperforming loan levels have also declined, the District's coverage ratio of loan-loss reserves to nonperforming loans remained at 128 percent, unchanged from 1987, and up from 75 percent in 1986.

Both decreases in nonperforming assets and increases in tangible primary capital resulted in a lesser encumbrance of District bank capital. Nonperforming assets as a percent of tangible primary capital declined to 14.52

FIGURE 16

Nonperforming assets — Seventh District



percent compared to 16.90 percent in 1987. (See Figure 16.) Tangible primary capital to tangible assets for the Seventh District in 1988 was 7.91 percent, up from 7.74 percent in 1987.

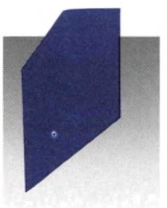
Conclusion

While traditional banking performance measures in 1988 harkened back to a calmer period for banking, the year was one that placed the industry in the center of revolutionary change. Basic, long held assumptions about bank product lines and competition became increasingly difficult to maintain, while regulatory reform and crisis resolution moved the banking industry toward less calm—and more unpredictable—weather.

Reconsidering the regional manufacturing indexes

Refinements in modeling industrial inputs and output can produce big gains in the accuracy of a regional index

Philip R. Israilevich, Robert H. Schnorbus, and Peter R. Schneider



Regional manufacturing indexes have been gaining popularity in recent years, as more and more Federal Reserve Banks have made them available to the public. Currently, five of the twelve Banks (Chicago, Cleveland, Philadelphia, Richmond, and Dallas) regularly publish manufacturing indexes.[1] As a more comprehensive measure of manufacturing activity than employment data, these indexes can be a valuable tool for monitoring current economic conditions in a region. Moreover, as estimates of regional industry output, these indexes can be incorporated in a variety of research models to test theories of regional growth and structural change. For whatever purpose the indexes may be used, the Federal Reserve Banks are committed to providing the highest quality indexes possible and research on improving the indexes is continuing.

In this paper, previously developed methods for constructing indexes of regional manufacturing activity are reviewed and new methods tested, using the database of the Midwest Manufacturing Index (MMI). In the first part of this study, three nonparametric methods for constructing indexes are presented. In simplest terms, nonparametric indexes are essentially weighted averages of two inputs—labor and capital services, the major components of output. (All indexes currently in use are nonparametric models, in that the weights, or parameters, do not require empirical estimation.) In the second part of this study, five parametric models are tested, using standard econometric techniques, to estimate empirically the relationship between output and its inputs. The objective of each part is to determine which method can most accurately forecast output two years ahead. In the conclusion, an overall comparison of the eight methods is made.

The most commonly used method for constructing manufacturing indexes was developed in 1970 by the Federal Reserve Bank of Atlanta.[2] The Atlanta method, which is a nonparametric method, has become the standard approach, largely because of a study by Fomby.[3] His study, which reviewed various methods for constructing indexes, found that the Atlanta method outperformed both parametric and other nonparametric methods. In taking a fresh look at both parametric and nonparametric methods, however, this study concludes that alternatives do exist that are easy to use and more accurate than the Atlanta method.

Fomby's experiment on the accuracy of manufacturing indexes is reproduced here with several modifications. First, tests of forecasting accuracy are limited to two years ahead, rather than the five-year forecast in the Fomby study. Since data used in constructing the indexes are rarely more than two years out of date, the ability to forecast beyond two years is seldom required to extrapolate existing data to

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the present date. With only thirteen annual observations to build the indexes, a two-year forecast will be more accurate than a five-year forecast.

A second fundamental change is the selection of individual manufacturing industries for modeling, as opposed to the aggregated manufacturing sector.[4] Industries at the two-digit level of Standard Industrial Classification (SIC), e.g., primary metals or transportation equipment, could have growth patterns substantially different from the manufacturing sector on average, and the accuracy over the forecast period can be improved by capturing those diverse patterns over the estimation period.

The third and major innovation of this study is the introduction of a new variable—payroll earnings. Payroll earnings are an important component in constructing regional indexes. However, the variable has typically been approximated, despite the fact that payroll data are available monthly in the Bureau of Labor Statistics' (BLS) *Employment and Earnings* publications. Incorporating the payroll variable into the analysis requires some modification of the traditional neoclassical production function, but increases the explanatory power of the model by introducing more variables into the analysis.

The eight models (five parametric and three nonparametric) developed in this study are tested over the period 1972–85. For the in-sample period (from 1972 through 1983), models are estimated, using data from the Annual Survey of Manufacturing (ASM) data. For forecasts of the out-of-sample period (1984 and 1985), only data reported by the BLS are used. The object of the test is to determine which model generates the lowest mean absolute error for the estimates of total manufacturing output (i.e., value added) in 1984 and 1985, when compared to the known out-of-sample values. For this study, only annual projections are made. However, in reality the data allow one to make monthly interpolations between annual projections of the estimated model. The monthly estimates are the ultimate objective of regional manufacturing indexes.

Nonparametric models

The nonparametric methods of forecasting regional manufacturing output can be contrasted by two approaches: the Atlanta method and the Chicago method (nonparametric version). Because of underlying similarities of the two models, the Atlanta method will be described in detail, while the Chicago method will be discussed only where it differs from the Atlanta method.

To begin with, the Atlanta method breaks down the value of output (represented by value added) for each industry in the region into two basic components—total cost of labor and total cost of capital services. The capital services component includes other factors, such as business services and overhead costs, as part of value added. Other factors, such as cost of energy and materials, are already excluded from shipments to derive value added. All nominal values are deflated by industry-specific price deflators in order to create "real" values.[5]

As the first model to be tested for its accuracy, the basic equation of "real" output for each regional industry takes the form of the Atlanta method:

1) $VA = (S_L * Q_L * L) + (S_K * Q_K * K)$

where:

VA = regional output (measured by value added in constant dollars)
S_L = payroll earnings per value added in constant dollars (or share of labor)
L = total hours worked (amount of physical labor input)
Q_L = value added per L in constant dollars (productivity of labor)
$S_K = 1 - S_L$ (share of capital services)
K = kilowatt hours (proxy for amount of capital services)
Q_K = value added per K in constant dollars (productivity of capital services).

Since deflated ASM values for value added and payroll were used for the in-sample period (1972–1983), Equation 1 leads to an identity, i.e., value of output must equal the value of all inputs. However, projections of the out-of-sample years (i.e., 1984–1985) required some assumptions about the trends in labor and capital shares (S_L and S_K) and the trends in labor and capital productivity (Q_L and Q_K). Following the Atlanta convention, factor shares were held constant at their 1983 levels. The productivity adjustments were allowed to grow at their average annualized rate of growth between 1972 and 1983. That is:

$S_{L84} = S_{L85} = S_{L83}$
$S_{K84} = S_{K85} = S_{K83}$
$Q_{L84} = Q_{L83} + \{(Q_{L83}/Q_{L72}) - 1\}$
$Q_{L85} = Q_{L83} + 2*\{(Q_{L83}/Q_{L72}) - 1\}$
$Q_{K84} = Q_{K83} + \{(Q_{K83}/Q_{K72}) - 1\}$
$Q_{K85} = Q_{K83} + 2*\{(Q_{K83}/Q_{K72}) - 1\}$

The Chicago method introduces monthly BLS payroll earnings data to approximate ASM payroll earnings. Interestingly enough, the product of S_L and Q_L is simply the price of labor, or the average wage rate for the industry (remembering that payroll earning is simply the price of labor times hours worked). The product of S_K and Q_K is the price of capital services. Since L and K are known, the model is essentially trying to predict input prices on an *ad hoc* basis. While the price of capital services remains unknown, the price of labor, i.e., wage rates or average hourly earnings, has long been known and is even available on a monthly basis. Furthermore, the cost of labor, or wage rate times hours worked, is readily available as payroll earnings, generated by BLS along with its collection of employment and hours data. In other words, one key variable over the forecast period does not have to be predicted, which theoretically should reduce forecasting errors.

For the calculation of capital services costs in the Chicago method, two different approaches can be used. The first approach strictly parallels the Atlanta method. As such, the second model to be tested simply takes the form:

2) $VA = PAY + (S_K * Q_K * K)$

where: PAY = payroll earnings.[6]

The second approach is a 'substitution' approach that can assume a linear relationship between the year-to-year change in the relative price of capital to labor and the capital-labor ratio. That is, one can start with the following regression:

3) $[(P_{Kt}/P_{Lt})/(P_{Kt-1}/P_{Lt-1})] = b * [(K_t/L_t)/(K_{t-1}/L_{t-1})]$

where:

P_{Kt} = price of capital in period t
P_{Kt-1} = price of capital in period t-1
P_{Lt} = price of labor in period t
P_{Lt-1} = price of labor in period t-1
K_t = amount of capital in period t
K_{t-1} = amount of capital in period t-1
L_t = amount of labor in period t
L_{t-1} = amount of labor in period t-1
b = regression coefficient.

The above equation is then estimated over the in-sample period. The price of labor is calculated by dividing payroll by the amount of labor. The price of capital, likewise, is equal to the total cost of capital divided by the amount of capital. Using the estimate of *b (b')* and the known variables in the above equation, an estimate for P_{Kt} (P_{Kt}') can be calculated:

3') $P_{Kt}' = b' * [(K_t/L_t)/(K_t\text{-}1/L_t\text{-}1)] * [(P_{Lt}/(P_{Lt-1} * P_{Kt-1})]$

The estimate for total cost of capital services would be $P_K' * K$. The third model to be tested, therefore, take the form:

4) $VA = PAY + (P_K' * K)$

The potential advantages of the Chicago method (either Equation 2 or 4) become apparent in a comparison with the Atlanta method (Equation 1). To begin with, the Atlanta method makes *ad hoc* assumptions about the growth rates of the factor shares and the productivity adjustments. In particular, the use of 1972 as the base year in the calculations of rates of change in factor shares and productivity adjustments over the projected period (1984–85) has no basis in theory. Calculating a rate of change over the longest period allowable by the data would seem intuitively to give the best estimate by avoiding short-term disruptions to the trends. But, in fact, not only does changing the base year result in different predictions of regional output, for some industries the prediction is more accurate if only the most current years are used and for others the best results are provided by using only years in the latter half of the sample period. Table 1 presents the results of the mean absolute errors using each of the years in the sample period as a base. Simply put, there is no single "best" year that can be chosen that will serve as the appropriate base year for *all* industries.

The Chicago method does not take the arbitrary approach of handling share and productivity factors contained in the Atlanta method, at least for its calculation of the labor component. Using the BLS hours and earnings data, a current figure for payroll earnings can be calculated. Unfortunately, that payroll number has gone through several adjustments

TABLE 1

Mean absolute errors of 1984–85 projections for various base years: Atlanta method (Equation 1)
(percent)

Industries by SIC	Base year										
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
20	7.78	5.42	5.36	5.50	6.86	5.82	5.39	4.61	4.05	3.26	4.04
24	8.36	10.28	10.10	8.10	9.48	8.53	10.21	17.81	15.66	17.86	12.57
25	7.84	8.45	7.02	6.37	5.34	7.68	7.48	7.62	7.64	2.28	7.38
26	3.71	4.31	4.16	2.16	1.92	3.48	4.70	2.88	3.58	1.26	10.90
27	4.00	4.66	2.64	1.21	1.00	1.39	1.35	4.12	7.50	10.00	12.44
28	1.48	1.24	2.80	5.88	6.62	7.22	6.70	9.35	12.27	19.78	20.88
29	29.36	34.24	27.21	23.14	31.10	33.80	41.97	7.60	40.16	10.75	12.93
30	7.26	7.84	7.58	4.86	1.55	7.19	5.38	1.32	5.31	5.58	1.08
31	7.00	6.88	7.29	7.56	7.96	7.94	7.18	14.97	16.42	20.91	17.48
32	8.64	9.48	7.75	6.28	5.82	6.34	7.42	5.97	2.29	5.02	4.02
33	16.67	17.00	16.82	13.60	14.65	14.66	16.98	12.72	12.62	12.56	6.69
34	1.40	1.46	2.16	3.14	2.58	2.62	3.62	6.99	11.66	13.86	10.00
35	6.76	7.76	7.74	5.48	5.81	7.02	7.86	8.62	4.72	6.72	4.31
36	6.74	7.21	6.96	5.08	6.82	8.60	9.44	10.00	7.12	4.61	2.26
37	16.70	16.20	17.46	18.12	16.40	17.00	17.03	15.58	25.18	28.50	35.66
38	8.20	9.94	10.44	7.86	7.94	7.57	7.96	8.08	4.56	4.96	12.95
39	1.56	1.21	1.65	2.60	1.40	2.48	1.86	2.62	15.84	14.46	2.87
Total	8.06	8.06	8.20	7.52	7.76	8.34	8.68	9.00	10.33	11.89	11.96

SOURCE: Federal Reserve Bank of Chicago.

(described in footnote 6) and these adjustments may not yield a close enough correlation to ASM payroll earnings to generate a better prediction than the Atlanta method.

Another option offered by the Chicago method is the choice between an *ad hoc* projection of the total cost of capital services and a projection with a theoretical foundation. Utilizing basic economic theory, one would expect a decrease in the capital–labor ratio, if there is an increase in the relative price between capital and labor. In other words, the substitution approach (Equation 4) can treat capital and labor as substitutes.

The results of the tests to determine mean absolute error in the projection of value added with a nonparametric approach are not encouraging. Indeed, as shown in Table 2, the Atlanta method did better than either of the models using the Chicago method. However, it was equally clear that the results were again not consistent across all industries. Some industries did much better using the Chicago method than the Atlanta method, and some industries did better using the Atlanta approach for projecting total capital costs within the Chicago method, even though the Atlanta method still provided the best overall model for constructing the manufacturing index.

Parametric models

Five parametric models are derived from a microeconomic foundation. As opposed to *ad hoc* methods, a microfoundation makes the results theoretically consistent, offers straightforward interpretation of the parameters, and presents additional material for microeconomic analysis. A traditional Cobb-Douglas (C–D) production function is initially applied to the sample data set, in order to repeat Fomby's experiment. However, unsatisfactory results necessitated some changes that resulted in a C–D-type model and a nonlinear model, both of which use L, K, and time as the only exogenous variables. For the first model, the restriction of linear homogeneity is removed from the traditional C–D model to derive a generalized C–D model. For the second

model, even greater nonlinearity is introduced through a functional form that allows for variable returns to scale and variable elasticities of substitution, based on the model introduced by Vinod.[7] Finally, a set of three models using the Chicago method (parametric version) are devised to incorporate payroll data, by utilizing a translog production function, based on the model developed by Christensen, Jorgenson, and Lau with all the traditional restrictions on the translog coefficients.[8]

To begin with, the most basic parametric model in this analysis is a generalized C–D model, where no restrictions on the sum of the coefficients, a_L and a_K, are imposed. As the fourth model in the series to be tested, then, the generalized C–D model takes the form:

5) $\ln VA = a_0 + a_L \ln L + a_K \ln K + a_T T$

where ln = logarithmic values of variables
t = time trend
(The time subscripts on variables are dropped for convenience.)

Another parametric model is a nonlinear model that includes the product of logs of labor and capital in addition to the traditional C–D variables. As the fifth model to be tested, the nonlinear model takes the form:

6) $\ln VA = a_0 + a_L \ln L + a_K \ln K + a_{LK} \ln L \ln K + a_T T$

Both this model (Equation 6) and the earlier model (Equation 5) present capital and labor as the only observed regressors (besides the time trend).

As mentioned above, the purpose of this analysis is to introduce payroll data into the forecast of the out-of-sample period. This purpose can be achieved by manipulating a translog production function of the general form:

7) $\ln VA = a_0 + a_L \ln L + a_K \ln K + a_{LK} \ln L \ln K + .5\, a_{LL} (\ln L)^2 + .5\, a_{KK} (\ln K)^2 + a_T T$

The first half of the right-hand side of the equation is identical to Equation 6. The quadratic terms in the second half of the equation add flexibility to the model, but do not yet introduce payroll data into the analysis.

Three steps are required to incorporate the variable, payroll earnings, into the analysis. The first is to substitute DLK = ln L – ln K into Equation 7. Due to the restrictions imposed on the translog function, Equation 7 can now be rewritten as:

7') $\ln VA - \ln K = a_0 + a_D DLK - .5\, a_{DD} DLK^2 + a_T T$

Note that this modification of the translog form reduces the number of variables in Equation 7 to the same number as in Equation 5, the unrestricted C–D form. This is especially beneficial in the case of a small number of observations (as is the case in this analysis). While a more general functional form than the traditional C–D model, the translog model with its parametric restrictions is not necessarily more general than the unrestricted C–D model (Equation 6).

In the second step for introducing payroll into the model, a derived demand for labor must be obtained. Assuming Shepard's lemma, the labor share (S_L) equation can be derived from the translog Equation 7):

TABLE 2

Mean absolute errors of 1984-85 projections for 1972 base year
(percent)

Industries by SIC	Atlanta (Eq. 1)	Chicago w/Atl exten. (Eq. 2)	Chicago w/subst. (Eq. 4)
20	7.83	4.94	10.14
24	8.36	15.74	12.22
25	7.84	5.04	9.03
26	3.70	4.20	7.22
27	4.00	0.62	0.56
28	1.48	2.39	14.03
29	29.36	17.58	14.92
30	7.26	10.54	20.57
31	7.00	7.28	30.84
32	8.64	3.10	1.80
33	16.67	16.76	23.25
34	1.40	2.08	0.28
35	6.76	2.13	2.26
36	6.74	5.44	6.83
37	16.70	25.42	39.18
38	8.20	9.68	19.59
39	1.56	2.76	1.48
Total	8.06	8.20	13.31

SOURCE: Federal Reserve Bank of Chicago.

8) $S_L = a_L + a_{LL} \ln L + a_{LK} \ln K$

where the right-hand side of Equation 8 is derived as the logarithmic derivative of *VA* in Equation 7 in respect to labor (*L*). Equation 8 can be modified to:

8') $S_L = a_L + a_{LK} DLK$

Substituting 8' into 7', one derives:

9) $\ln VA - \ln K = a_0 + S_L DLK + .5\, a_{LL} DLK^2$

In addition to the traditional regressors of labor and capital, Equation 9 now includes the payroll variable (as part of S_L). Note that the S_L variable is observed for the in-sample period (1972–83), *but is not observed for the forecasting period (1984–85)*. The problem is to find a way either to estimate a value for S_L, or to get it out of the equation without losing the payroll variable.

For the final step, three variations of Equation 9 are found to solve the problem, while accomplishing the purpose of including the payroll variable. As such, Equation 9 is the fundamental equation for this paper. For the first variation, payroll earnings (*PAY*) is assumed to have the same variations as the share of labor, so that *PAY* can be substituted directly into the model as a proxy for S_L. As a result, Equation 9 is modified to become the sixth model to be tested, with the form:[9]

10) $\ln VA - \ln K = a_0 + a_{PD} PAY*DLK + .5\, a_{LL} DLK^2 + a_t DUM*T$

where

$DUM = 0$ if < 1982

$= 1$ if > 1982

Utilizing Equation 10 and payroll earnings data, one can forecast the S_L variable in Equation 9. For the experiment, Equation 9 is estimated and then *VA* is predicted, using forecasted S_L. For estimation of Equation 9, one has to realize that S_L may deviate from the 'true' share variable, due both to assumptions imposed on the translog coefficients and to measurement errors. Therefore, the share variable is treated as a regressor in Equation 9. Equation 9 now becomes the seventh model to be tested, with the form:

11) $\ln VA - \ln K = a_0 + a_{SD} S_L DLK + .5\, a_{LL} DLK^2$

For most of the industries, the coefficient, a_{SD}, is significantly different from unity. The nominator for S_L (i.e., *PAY*) is derived from the BLS data and the denominator (*VA*) is estimated from Equation 10.

Finally, by substituting $S_L = PAY/VA$ into Equation 9 and rearranging terms, one can derive the eighth and final model to be tested, with the form:

12) $F = VA \ln VA - (\ln K + a_0 + .5\, a_{LL} DLK^2)\, VA - DUM*PAY = 0$

All variables in Equation 12 are observed for the out-of-sample period. Therefore, after estimating Equation 9, Equation 12 can be solved with respect to *VA*, in order to get forecasts for the out-of-sample period. Nonlinearity with respect to *VA* in this equation does not present a problem, since function *F* has only two roots. This can be inferred from the first derivative of *F* with respect to *VA*:

13) $F_{VA} = \ln VA + \text{constant}$

For practical purposes, *VA* is always greater than one, which insures the choice of one root.

In all, five parametric models are tested and five sets of forecasts are derived. Errors of forecasts are recorded in Table 3. A plus sign indicates the minimum value of the forecasting error for each industry. At the bottom of Table 3, weighted sums of errors are presented. Weights are derived from shares of value added for each industry for 1985. Errors in Table 3 are mean absolute errors, combined for 1984 and 1985. Errors of each procedure correspond to the indicated equation.

Among the parametric models, the use of only capital and labor variables fails to improve upon the accuracy of the Atlanta method (equation 1). This is consistent with Fomby's results. Moreover, only two industries (SIC 26, paper and paper products, and SIC 34, fabricated metals) have the best results using either equation 5 or 6.

The main objective of this analysis, however, is to determine whether the new variable, payroll, is beneficial to the index. Here, two models using the Chicago method (Equations 10 and 11) did better than models using only *K* and *L* as exogenous variables. Equation 10 provides the smallest error, only 7.3 percent for the combined two years. Indeed, this error

TABLE 3

Mean absolute errors of 1984–85 projections, parametric models
(percent)

Industries by SIC:	Models w/K & L		Translog model w/K, L & PAY		
	Generalized C–D model (Eq. 5)	Vinod model (Eq. 6)	PAY as proxy for S_L model (Eq. 10)	S_L as regressor model (Eq. 11)	Nonlinear model (Eq. 12)
20	0.134	0.126	0.071+	0.103	0.106
24	0.074	0.085	0.187	0.069+	0.156
25	0.068	0.073	0.009+	0.021	0.168
26	0.033	0.014+	0.023	0.017	0.017
27	0.052	0.126	0.046+	0.084	0.123
28	0.228	0.229	0.154+	0.291	0.256
29	0.364	0.278	0.179+	0.366	0.555
30	0.051	0.034	0.031+	0.158	0.145
31	0.229	0.093	0.159	0.119	0.090+
32	0.115	0.137	0.026	0.016	0.010+
33	0.224	0.226	0.297	0.124	0.026+
34	0.063	0.059+	0.061	0.102	0.087
35	0.061	0.092	0.024+	0.087	0.173
36	0.030	0.031	0.029+	0.064	0.139
37	0.118	0.132	0.084	0.023	0.019+
38	0.077	0.032	0.025+	0.047	0.239
39	0.052	0.063	0.024	0.051	0.023+
Total	0.100	0.107	0.073	0.093	0.115

NOTE: Plus sign (+) denotes lowest error per industry among parametric models.

SOURCE: Federal Reserve Bank of Chicago.

is 0.8 percentage points lower than the Atlanta method, which represents an improvement of 10 percent over the accuracy of the Atlanta method. Thus, if one is looking for a parametric method to construct indexes that is still relatively straightforward, Equation 10 would provide an index with better accuracy than the Atlanta method. Based on the data sample used in this study, therefore, *Fomby's finding that nonparametric models outperform parametric models is rejected.*

Finally, if one would choose the best results for each industry among the five parametric models in Table 3, based on the *a posteriori* results (indicated by pluses), the total error is reduced to only 4.3 percent for the combined two years—roughly half the error generated by the Atlanta method. An error of this small magnitude (averaging about 2 percent per year) is a substantial accomplishment and would strengthen the credibility of regional manufacturing indexes.

Building a better model

The basic findings of this study can be summarized as follows. First, in repeating Fomby's analysis of the accuracy of manufacturing indexes using the same variables but an entirely different set of data, this study derived identical results—the simple Atlanta method provides better results than any other nonparametric method or parametric method. Second, however, when the new variable—payroll earnings—is added to the models, Fomby's results are completely reversed. With the new variable, the parametric models do better than nonparametric models. Finally, and most importantly, the study finds that no single method can be found that produced the lowest mean absolute errors for all industries in the set. In other words, even better results can be obtained by modeling each industry individually to find the lowest predicting error, and then combining all the industry series into an aggregate manufacturing index, based on

weights derived from each industry's share of total value added.

The results of this study are interesting from a purely academic perspective, but they have a very direct application as well. As regional manufacturing indexes gain wider usage both inside and outside the Federal Reserve System, the accuracy of these indexes will become an increasingly important issue. As more indexes are tested for the best models, discoveries and innovations can be quickly incorporated into other regional indexes. Work currently underway to revise the Midwest Manufacturing Index builds on the knowledge gained by this study and is expected to improve significantly the accuracy of the index. The ultimate goal of research in this area should be to develop regional indexes that have as much credibility as the Federal Reserve Board's Index of Industrial Production.

FOOTNOTES

[1]See, for example, *Chicago Fed Letter*, Federal Reserve Bank of Chicago; *The Southwest Economy*, Federal Reserve Bank of Dallas; *Mid-Atlantic Manufacturing Index*, Federal Reserve Bank of Philadelphia; *Cross Sections*, Federal Reserve Bank of Richmond; and *Economic Trends*, Federal Reserve Bank of Cleveland, various issues. Indexes also are incorporated into analyses of business conditions of District economies. See, for example, Israilevich and Schnorbus (1988) and Schnorbus and Israilevich (1989).

[2]See Pym, C.S., 1970.

[3]See Fomby, 1986.

[4]The total index is then calculated as a weighted average of all the industries (seventeen, in the case of the MMI), using each industry's annual share of total value added in the region.

[5]The amount of physical output produced in a region is approximated by the current dollar value of shipments less cost of materials (i.e., value added) that is adjusted for inflation. This method of approximating "real" output is vulnerable to a variety of problems that are common to deflators, but for which there are few alternatives. For further discussion, see A.S. Giese, (1989).

[6]While BLS employment data cover both the number of production and supervisory workers in the same way as ASM employment, BLS coverage of payroll earnings differs from ASM coverage. BLS earnings data cover only production workers. Therefore, a two-step adjustment needs to be made to the BLS earnings data in order for them to represent earnings of total employees on an ASM basis. First, using ASM data from the in-sample period, a ratio of total earnings to production earnings can be calculated. Then, using this ratio, the following adjustment to BLS production earnings per worker can be made:

$$EARN' = EARN * TE83/PE83 * [1 + \{(TE83/PE83/TE72/PE72) - 1\}]$$

where:

TE83 = total earnings in 1983 (ASM data)
TE72 = total earnings in 1972 (ASM data)
PE83 = production earnings in 1983 (ASM data)
PE72 = production earnings in 1972 (ASM data)
EARN = production earnings per worker in 1984–85 (BLS data)

Second, payroll earnings on a ASM basis (RP_{BLS}) for total employment is then calculated by multiplying the adjusted earnings (EARN') by total employment (EMP) from BLS, such that:

$$RP_{BLS} = EMP * EARN'.$$

An additional, adjustment is made to account for differences in sampling between ASM and BLS data, which was done in the following manner:

$$RP_{ASM} = DUM + bRP_{BLS}$$

where:

DUM = 1, if year $\leq$ 1975
0, if year > 1975
RP_{BLS} = real payroll earnings (BLS data)
RP_{ASM} = real payroll earnings (ASM data)
b = regression coefficient on RP_{BLS}.

The estimate of payroll earnings to be used in the model, then, is:

$$PAY = b' * RP_{BLS}$$

where:

PAY = calculated value of real payroll earnings
b' = estimate of b

[7]See Vinod, 1977.

[8]See Christensen, et al (1973).

[9]Because payroll data are provided by both ASM and BLS, alternative selections of this variable are created for the in-sample period. (For the out-of-sample, only BLS data are available). The differences between the BLS and ASM sources were greater at the beginning of the period than at the end of the period. The two last years of the in-sample period represent the beginning of a new business cycle. For these two reasons, payroll for the 1982 and 1983 period was adopted from BLS. This, in turn, requires the addition of a dummied time variable, DUM*t.

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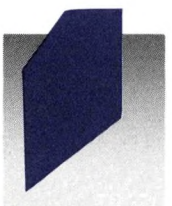
Testing the "spread"

The difference between interest rates on long Treasuries and the fed funds rate looks like a useful economic indicator; if so, 1989's "soft" landing may be harder than many hoped for

Robert D. Laurent



The 1980s have been difficult years for monetary policy. Through the 1970s, policymakers had increasingly relied on changes in monetary growth rates as a policy guide. However, the relationship between money growth and the real economy appeared to deteriorate and become less reliable in the early 1980s. In response to this problem, two basic approaches are possible. One may try to repair the monetary aggregates or one may look for a new indicator. The notion here is that the monetary authority would find useful a leading indicator of the real economy which is also to some extent under its influence.

The second course was followed, and a new indicator suggested, in an article published in this review at the beginning of 1988.[1] That study showed that the "interest-rate spread"—the difference between the yields on a long-term government bond and overnight federal funds (on a bond-equivalent basis)—increased before real GNP accelerated and decreased before real GNP decelerated. The spread performed better in forecasting future changes in real GNP over the period 1964–1986 than many different monetary aggregate growth rates and a few other interest rate-based indicators. Perhaps most important, the spread forecast best even over a truncated period ending in 1979, before the time when the monetary aggregates are widely thought to have deteriorated.

Although the results of the earlier study seemed to indicate that the spread would be a promising monetary policy indicator, the evidence in that study is hardly conclusive. The fundamental problem is that the same data used to formulate a hypothesis cannot simultaneously be used to test that hypothesis. Economists have developed elaborate techniques that attempt to establish whether a relationship observed over some past data is significant; yet the history of economic research is full of examples of relationships that have tested as significant over past data only to fall apart as soon as they were applied to new data. The earlier study attempted to reduce the probability of accepting a spurious relationship by estimating only with data available at the time a forecast would have been made, but nonetheless it remains a study based only on data that had already been observed. The only true test of a relationship is its ability to explain new data. The surest way to test a relationship on new data is to use the relationship to forecast the future.[2] This paper examines the forecasting performance of the interest rate spread on the data that have appeared since the data used in the earlier study.

The first section of this article examines some general characteristics of indicators and some specific properties of the interest-rate spread developed in the earlier study. The second section takes a detailed look at the forecasting performance of the spread over recent years. The third section looks at the current level of the spread and its implications

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for future economic activity. The last section discusses some of the benefits of the spread for monetary policy.

The spread as an indicator

Indicators generally are not used to forecast specific values of the variables in which one is interested. Rather, indicators are used to obtain a general idea of the direction of movement in such variables. For example, the index of leading indicators typically is not used to forecast the specific growth rate of future real GNP. Instead, rules of thumb based on movements in the index are used to give a general idea of movements in real GNP, e.g., three consecutive down months for the index presage a recession. Some indexes designed to predict future movements in the stock market consist of the number of individual indicators moving up minus the number of individual indicators moving down. This kind of index is considered to have given a significant signal when a preponderance of the indicators move in one direction. Thus, indicators are a shorthand way of trying to forecast movements in the variable of interest.

Economic theory suggests that no single economic variable serving as an indicator is likely to predict the real GNP of a complex economy accurately. For example, although the rate of change in real M2 is used by some analysts as a measure of monetary policy and is also a component in the index of leading indicators, it is well known that factors affecting the demand for money alter the impact of money changes on real GNP. Any hope of accurately forecasting growth in real GNP requires incorporating the effects of factors such as the opportunity cost of holding money balances. The practice of using a single variable as an indicator is a reflection of both the desire to keep an indicator simple and the difficulty of improving an indicator while incorporating other factors.

In order to compare the performance of various indicators it is helpful to find some way to quantify their predictions. The earlier study, in an admittedly gross simplification, estimated a linear relationship relating changes in real GNP to a constant and as many as eight lagged quarterly values of the indicator. The specific coefficients in the relationship were estimated by ordinary least squares regressions using only the data that would have been available when the forecast of a given quarter's real GNP was made. The different forms of each relationship were tested by how they would have forecast real GNP growth over the period 1964–1986. This period was chosen because it was the longest period over which data for all the monetary aggregates and interest rates that were used in the earlier tests were available.

When tested in the manner described above, the best model (as measured by the root-mean-squared error of forecast) for each indicator was found to include only one or two lagged values of the indicator. The two equations at the top of Table 1 show the best forms of the equation for the interest-rate spread and the best of the money growth rates (real M2). The first equation indicates that the growth in this quarter's real GNP is affected only by the spread between the long-term bond rate and the federal funds rate two quarters earlier. The second equation indicates that the growth in real GNP next quarter is affected by the rates of growth in real M2 in this quarter and last quarter.[3] The bottom two equations in Table 1 give the specific coefficients one obtains by estimating these relationships over the period from the second quarter of 1961 through the first quarter of 1989. These would be the equations used to estimate the growth in real GNP for the second quarter of 1989.

The linear relationships between the indicators and real GNP growth is a simplification in yet another respect. The monetary authority has wide latitude to set the rate of change in real M2 or the spread between a long-term bond rate and the fed funds rate over sustained periods of time. Does this mean the monetary authority can change the real growth rate of the economy over sustained periods of time? Economic theory suggests that the answer to this question is no. If the monetary authority tried to implement a policy that produced a faster-than-sustainable level of growth in real income it might succeed for a time, but eventually the policy would produce accelerating levels of inflation. This would eventually lead to a disruption in the functioning of money in the economy and a reduction in real income.

Thus, the linear relationship between a policy indicator and real economic growth is useful only as long as it does not collapse

TABLE 1

General and specific forms of the linear regression relationship between real GNP growth and monetary policy indicators

General form

Interest-rate spread

$PCRGNP = const. + c_2 * r20mffr_{-2}$

Percent change in real M2

$PCRGNP = const. + c_1 * pcrM2_{-1} + c_2 * pcrM2_{-2}$

Specific form

(estimated with data from 1961II-1989I)

Interest-rate spread

$PCRGNP = 3.027 + 1.154 * r20mffr_{-2}$

Percent change in real M2

$PCRGNP = 1.825 + .326 * pcrM2_{-1} + .130 * pcrM2_{-2}$

Glossary of variables

PCRGNP = Quarterly change in real GNP at an annual rate.

r20mffr = Interest rate spread in percent, the linked 20-year-30-year constant-maturity treasury bond rate minus the federal funds rate (on a bond-equivalent basis).

pcrM2 = one plus the percentage change in M2 in the quarter at an annual rate, divided by one plus the percentage change in the CPI over the quarter at an annual rate minus one.

subscripts = the number of lagged quarters.

because policy has been pushed to an extreme. An analogy may help clarify this situation. One might describe the relationship between the pressure exerted on an accelerator and the velocity of an automobile as a linear relationship where a given increase in pressure increases velocity by the same amount, regardless of its initial level. Clearly though, there is some point at which further pressure on the accelerator no longer produces the same increase in velocity; and just as clearly there is some point at which further easing in the pressure no longer produces the same decrease in velocity. The linear relationship holds as long as one is in the middle range but is not likely to hold at extreme values. The same also is true of indicators of the effects of monetary policy on real GNP.

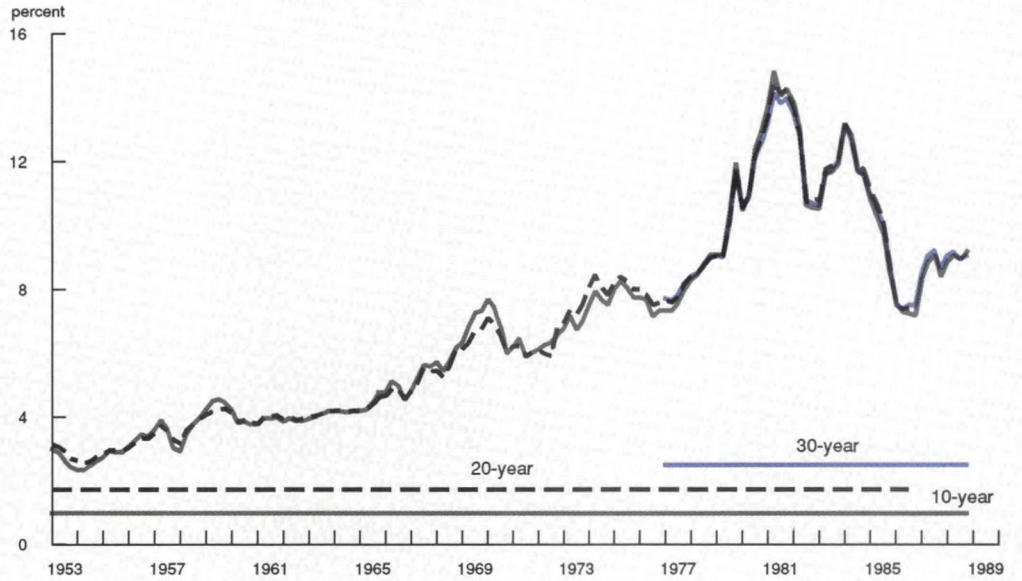
The justification for the specific form of the spread was presented in more detail in the earlier study, but a brief description is provided here. The Federal Reserve implements policy by affecting a short-term interest rate (specifically, the overnight federal funds rate). It is universally acknowledged that policy is made tighter by raising and easier by lowering this rate. However, history shows that the same level of the fed funds rate can be expansionary in one economic environment and contractionary in another environment.

A clue is provided by the relationship between very short-term rates heavily influenced by monetary policy and long-term rates that are most insulated from monetary policy. The lower is the short-term rate relative to the long-term rate, i.e., the steeper the yield curve, the more expansionary is policy and the more rapid is expected future real economic growth.[4] The federal funds rate is the obvious choice for the short-term rate. The 20-year constant-maturity Treasury rate was chosen as the long-term rate because it was the longest constant-maturity Treasury rate available for an extended period. The earlier tests covered the period 1964–1986 because that was the longest period over which all the alternative indicators were available, with 1986 being the last year the 20-year constant-maturity Treasury rate was published.

In order to test the performance of the interest rate spread beyond 1986, it is necessary to find a long-term rate to replace the 20-year constant-maturity Treasury rate. The three longest constant-maturity Treasury bond rates available for any portion of the last 35 years are the 10-, 20-, and 30-year rates. As Figure 1 shows, there are no substantial differ-

FIGURE 1

10-, 20-, and 30-year constant maturities



ences in the patterns of these three rates, so predictions using these three rates as the long-term rate are not likely to differ greatly. A series for the long rate was constructed by taking the longest constant-maturity Treasury rate available at any time. This series, with the 20-year rate through the first quarter of 1977, and the 30-year rate since, is used to carry the analysis of the spread past 1986.

Figure 2 plots real income and the spread between the linked 20-year–30-year bond rate and the federal funds rate over the period 1955–1989. The figure shows that for major moves, the spread generally behaves as expected, narrowing before economic activity slows and widening before economic activity accelerates. The figure also indicates that the range of the spread over this period (on a quarterly average basis) has been from +3.05 percentage points (+305 basis points) to –5.61 percentage points (–561 basis points). Yet the distribution is skewed over that range so that, despite the fact that 65 percent of the range is in negative territory, only 26 percent of the observations are negative. The mean quarterly average reading is +37 basis points, yet more than three-fifths of the observations lie above the mean. The half of the observations between the 25th and 75th percentile lie roughly between 0 and +170 basis points. The picture is one in which the spread is typically positive but occasionally goes very negative.

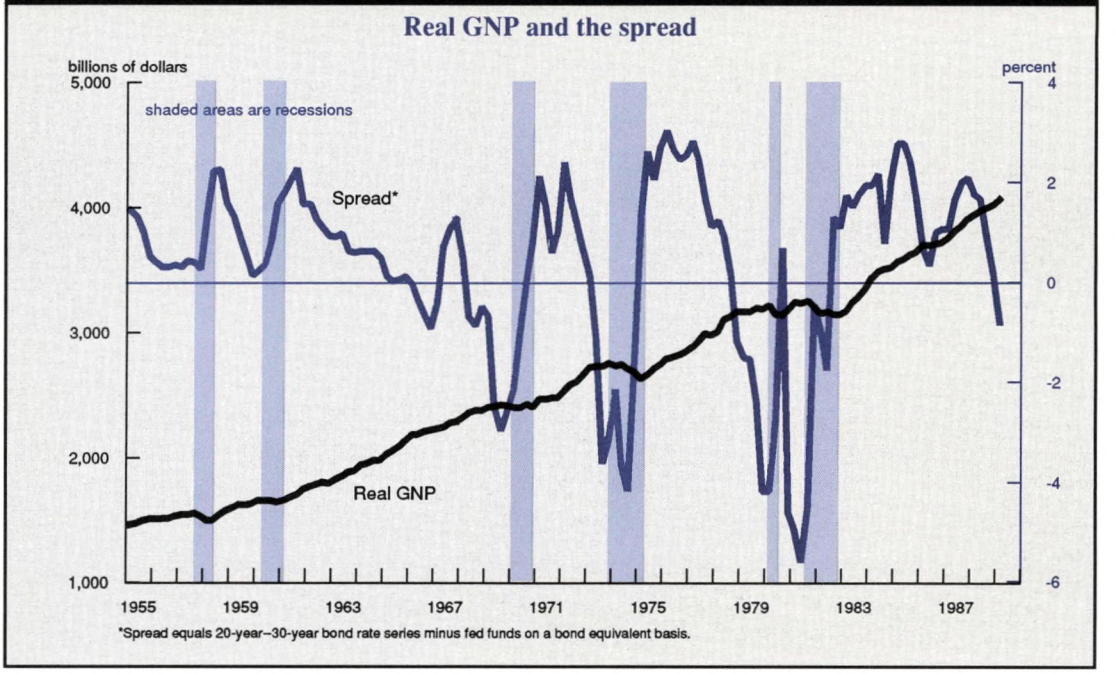
Figure 2 gives a broad perspective of the relationship. However, it must be remembered that the GNP of a complex economy is affected by many factors outside the control of the monetary authority. The relationship between the spread and real GNP is likely to be disturbed by these factors. Thus, the spread will not predict real income precisely. It may, nonetheless, be useful.

By plotting the growth in real GNP and separate monthly data for the two components of the spread, Figure 3 allows a more detailed short-term analysis of the behavior of the spread and its relationship to growth in real GNP over the expansion of the last six years. The bars in the figure plot the annual rate of growth in real GNP for each quarter, and the bottom line plots the spread.

Recent behavior of the spread

In October 1982, the Federal Reserve shifted emphasis from an operating procedure based on nonborrowed reserves back toward its pre-1979 procedure focused on money market conditions. This shift occurred at a time when the economy was coming out of the deep 1981–82 recession and when interest rates, both short and long, were falling. The fall in the federal funds rate had generally

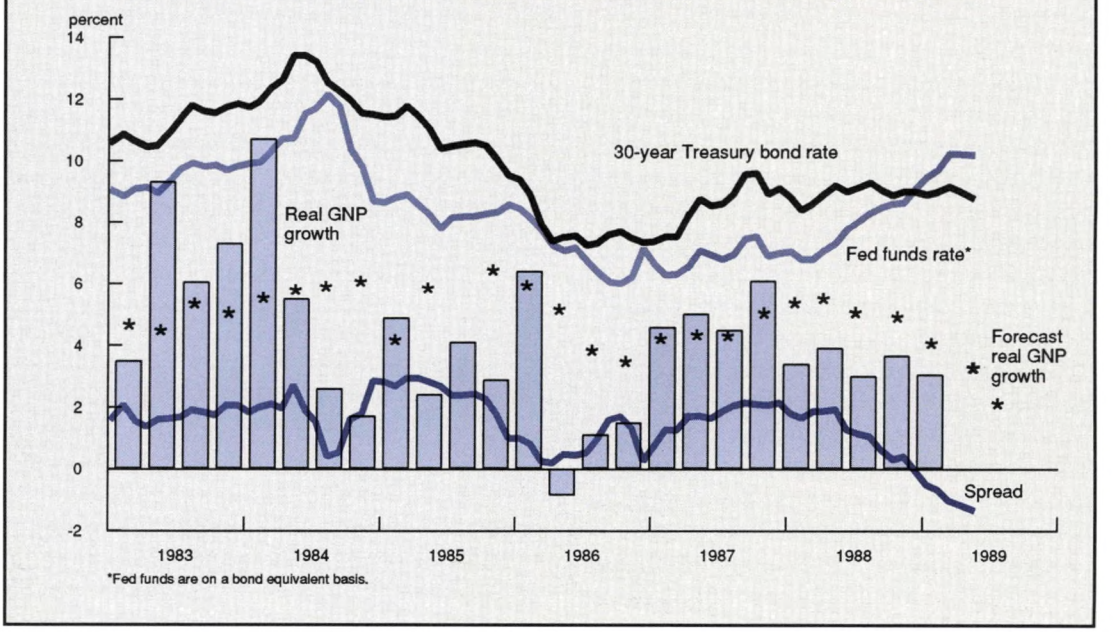
FIGURE 2



been steeper than the fall in long-term bond rates through 1982. The spread, which had been negative, turned positive in July 1982 and remained positive the rest of the year. In January, 1983, the fed funds rate of 9.0 percent was historically high, but it was not high relative to the 30-year bond rate of 10.6 percent.[5] In the fourth quarter of 1982, real GNP grew for only the second time in five quarters, but at only a slim 0.6 percent rate. In the first quarter of 1983 real GNP rebounded to grow at a 3.5 percent annual rate.

The federal funds rate rose about 100 basis points between the beginning of 1983

FIGURE 3



and February 1984, with the major part of the increase occurring between May and August of 1983. The 30-year bond rate followed the same pattern but rose by about 130 basis points to about 11.9 percent in February 1984. As often happens in the period immediately following a recession, real GNP grew rapidly (at an annual rate of 7.5 percent) through the last three quarters of 1983.

In the first quarter of 1984, real GNP expanded at the most rapid pace (10.7 percent annual rate) of any quarter between 1978 and the present. The federal funds rate rose at a much quicker pace in early 1984, from about 10.0 percent in February to about 12.2 percent by August 1984. Not all of this increase was policy-induced; under the Federal Reserve's operating procedure of the time, Continental Illinois' solvency problems had the effect of independently pushing up the federal funds rate. The 30-year rate rose even faster early in the year but, as Figure 3 shows, it peaked in June (actually on a weekly basis in late May at 13.8 percent), and then began a steep decline. The average spread for May 1984 was +269 basis points. Through the months of June, July, and August of 1984 the federal funds rate rose while the 30-year bond rate was falling. As a consequence, the spread closed rapidly from +269 basis points in May to +39 basis points in August. This sharp narrowing of the spread appears to have been associated with a slowing of real GNP in the second half of 1984. Real GNP growth was 2.6 percent in the third quarter and dropped to 1.7 percent in the fourth quarter.

From the third week in August until the last week in December, the federal funds rate fell from 12.3 percent to 8.2 percent, one of the steepest declines in the funds rate in a non-recessionary period in history. Although the 30-year bond rate also fell through the end of 1984, the steeper drop in the funds rate increased the spread from +39 basis points in August to +284 basis points in December 1984. This widening in the spread apparently reversed the impact of the earlier narrowing and the economy grew more rapidly beginning in the first quarter of 1985 when real GNP grew at a 4.9 percent annual rate.

Both the federal funds rate and the 30-year bond rate declined at about the same pace through the first nine months of 1985, maintaining a relatively wide spread, in a range between +230 and +290 basis points. Then, in October, the 30-year bond rate began to drop in a move that was to become one of the sharpest bond market rallies in U.S. history. From September 1985 to April 1986 the 30-year bond rate fell from 10.6 percent to 7.4 percent. All the reasons for this sharp decline in long-term rates are not clear, but a precipitous fall in crude oil prices and the passage of the Gramm-Rudman law must have been contributing factors.

The steep fall in the 30-year bond rate that began in the last quarter of 1985 and continued into early 1986 had, as interpreted by the spread, the effect of sharply tightening monetary policy. The federal funds rate was roughly 8.1 percent in both September 1985 and February 1986, but the fall in long-term bond rates between these two dates caused the spread to narrow sharply from +242 basis points in September 1985 to +80 basis points in February 1986. With the plunge in oil prices reducing the threat of inflation, monetary policy was free to lower the federal funds rate. Under the Fed's operating procedure at the time it was difficult for the funds rate to be lowered without cutting the discount rate.[6] Between February and August of 1986 there were four 50-basis-point cuts in the discount rate. These rate cuts succeeded in lowering the funds rate from 8.1 percent in February 1986 to 6.1 percent in August. After the first two discount rate cuts, the funds rate was 100 basis points lower while the 30-year bond rate had fallen even more, so that by the middle of April the spread had narrowed, as measured weekly, to about +10 basis points. This sharp narrowing of the spread between September 1985 and April 1986 appears to have also been associated with a slowdown in economic activity. The second quarter of 1986 saw real GNP decline slightly (–0.6 percent annual rate) and the last two quarters of the year saw positive, but weak, growth (1.0 and 1.4 percent annual rates respectively).

The two discount rate cuts in July and August 1986 were associated with a drop in the Fed funds rate from 7.1 percent in June to 6.1 percent in September. These discount rate cuts were accompanied by a rise, rather than a fall, in the 30-year bond rate. Between mid-April and October 1986 the spread widened

from +10 basis points to +170 basis points. The spread was at this same level in March 1987, though a particularly extreme case of the typical yearend rise in the funds rate produced a sharp, but clearly temporary, narrowing in the spread.[7]

Following the widening of the spread between April and October 1986, the pace of economic growth rebounded beginning in the first quarter of 1987 (4.6 percent real GNP growth) and continued through the first three quarters of 1987 (averaging 4.7 percent real GNP growth for three quarters). In April, the Fed began to gradually raise the fed funds rate in a move that extended through the second and third quarters of 1987. From its level of 6.3 percent in March 1987, the federal funds rate rose to 7.5 percent by September 1987. However, a much sharper rise in the 30-year bond rate (from 7.6 percent to 9.6 percent) meant that the spread actually widened by 80 basis points over this period to a level of about +213 basis points in September 1987.

This pattern of increases in the funds rate, the 30-year bond rate, and the spread continued right up to the memorable day of October 19, 1987, when the stock market suffered its sharpest one-day drop in history. On the day preceding the crash, the funds rate was 7.80 percent and the 30-year bond rate 10.25 percent, giving a very wide spread of +245 basis points. The price of the long bond continued to fall (reaching a yield of 10.40 percent) until mid-morning of Black Monday when the stock market had fallen 200 points. At this point, the psychology of the bond market reversed completely. As the stock market continued to plunge toward its final loss of 508 points on the Dow Jones Industrials, the long-term government market moved to perhaps its biggest 24-hour gain in history. By the end of the day the 30-year bond rate had fallen to 9.49 percent. Within three weeks the 30-year bond rate had fallen to a level of 8.85 percent.

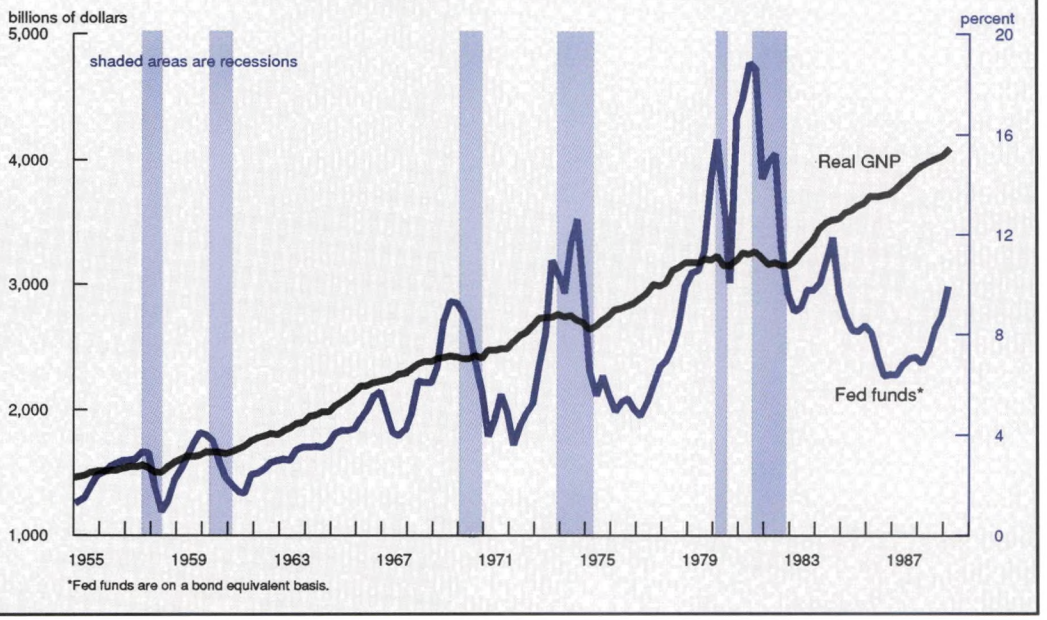
According to almost any school of economic thought, the proper monetary policy response to the stock market crash, engendering as it did vast amounts of fear amid widely resurrected recollections of the stock market crash of 1929, was a lowering of the funds rate. And, indeed, the fed funds rate did drop from 7.8 percent on the eve of the crash to 6.9 percent within three weeks. Despite the fall in the 30-year bond rate, the response of the Fed was sufficiently vigorous to prevent a decline in the average spread in the fourth quarter of 1987 from its third-quarter level.

The situation at the end of 1987 presented an interesting test of alternative forecasts of the economy. Following its largest one-day decline in history on October 19, 1987, the stock market stood far below its August high. Monetary growth had been weak through the last ten months of 1987. The performance of both money and stock prices helped dampen the index of leading indicators, which declined for five straight months from September 1987 to January 1988. In November, the consensus of the Blue Chip survey of forecasters experienced its largest one-month drop in expected future real growth. Yet, the spread clearly indicated there would be no contraction. At a +205-basis-point average in the fourth quarter of 1987, the spread was wider than at any other time from the third quarter of 1985 to at least the first quarter of 1989. In addition, there was another sign indicating that the economy was not entering a recession. As can be seen in Figure 4, which plots the federal funds rate and real economic activity for the period 1955–1989, every recession over this period was preceded by a rising federal funds rate. By December 1987 the federal funds rate had been lowered about a hundred basis points from its peak in October. Because the earlier study was published at the end of 1987, it provided an important public test of the spread as an indicator of future real GNP growth.

The economy appears to have expanded at a robust pace through all four quarters of 1988.[8] After adjusting for the effects of the drought, the average quarterly growth, at an annual rate, was 3.5 percent in 1988 and the weakest quarter was 3.0 percent.[9] By March 1988 it seemed clear that no recession was going to result from the stock market crash. From a level of 6.8 percent in March 1988, the funds rate was raised steadily until March 1989 when it stood 340 basis points higher at 10.2 percent. Figure 3 shows that, although the federal funds rate started to rise in March, the spread did not begin to contract until June and averaged +167 basis points as late as the second quarter of 1988. The spread has narrowed in each quarter since, averaging +91 basis points in the third quarter and +20 basis

FIGURE 4

Fed funds and real GNP



points in the fourth quarter of 1988. The spread turned negative in December and averaged –77 basis points in the first quarter of 1989. This pattern in the behavior of the spread indicated that a slowdown in the rate of real economic growth was likely to appear in the first or second quarter of 1989 and that the rate of growth would decelerate through at least the third quarter of 1989. Just how sharp that deceleration is likely to be is discussed in the next section.

This detailed examination of movements in the spread and real GNP growth over the last six years of economic expansion indicates that the relationship between them behaves, at least qualitatively, as hypothesized. Accelerations in real GNP growth follow widenings in the spread and decelerations in growth follow narrowings in the spread. The lag between changes in the spread and subsequent changes in real activity appears to be roughly two quarters. Although indicators are not typically used to make precise forecasts, a quantitative measure of how well the spread has performed recently may be obtained by extending the procedure used to test alternative indicators in the previous paper. Using the linked 20-year and 30-year bond rates to replace the 20-year bond rate used in the earlier study, a forecast of each quarter's real GNP growth was obtained by estimating the coefficients in the simple linear relationship presented in Table 1, using only the data that would have been available when real GNP growth had to be forecast. This relationship forecasts this quarter's real GNP growth using only the average spread from two quarters earlier.

The actual forecast for each quarter obtained from the spread in this way is shown on Figure 3 by an asterisk. Again, the forecast pattern conforms very roughly to the actual pattern observed, although the specific forecasts through the slowdowns in 1984 and 1986 appear to indicate, for those episodes, a lag somewhat shorter than two quarters. The root-mean-squared error of the forecasts over the period since the end of 1986 is 1.30 percentage points. This is substantially less than the root-mean-squared error reported in the earlier study (3.61 percentage points) for the period 1964 through 1986. One factor reducing the more recent forecast errors is the absence of very sharp fluctuations in real GNP growth in the recent period. But it should be noted that even a forecast of no slowing in growth following the stock market crash was not a trivial accomplishment. Figure 5, for example, clearly shows the weakness in real M2 growth in the last 10 months of 1987 that led some to expect a fall in real GNP growth in the wake

of the stock market crash. It should also be noted that while recent forecasts of real growth based on the spread relationship mirror movements in actual real GNP growth, they tend to underestimate the amplitude of both the accelerations and decelerations. This is typical with forecasts extended beyond the sample estimation period.

Current policy posture

The performance of the spread over the past year indicates that economic activity will be slowing over 1989. How sharp will the slowdown be? One estimate can be obtained from the linear relationship estimated with data through the first quarter of 1989 and presented at the bottom of Table 1. Applying the spreads for the fourth quarter of 1988 (+20 basis points) and the first quarter of 1989 (– 77 basis points) forecasts a real GNP growth of 3.2 percent for the second quarter of 1989 and 2.1 percent for the third quarter of 1989. If correct, this represents a relatively modest slowing in economic growth.[10]

Another analytical approach leads to generally compatible conclusions. Financial market analysts have focused a great deal of attention on the yield curve since short-term rates generally rose above long-term rates towards the end of 1988, i.e., since the yield curve has "inverted." Analysts have examined the extent and duration of past inversions. While the evidence varies slightly depending on the specific short-term and long-term rates used, the general conclusions can be seen in Figure 2, which shows five previous inversions of the spread between the linked 20-year and 30-year constant-maturity Treasury bond rate and the federal funds rate. The last four of these five inversions led to the last four recessions. Past inversions have typically been very long and deep. The average duration of the five inversions is slightly more than 21 months and the maximum inversion (using monthly data) averaged –486 basis points. One way to interpret these results is that the current inversion that began in December 1988 and averaged –137 basis points in May 1989 would have to go much deeper and last much longer before causing a recession.[11] So by extension, the inversion seen so far is likely to lead to a mild slowdown.

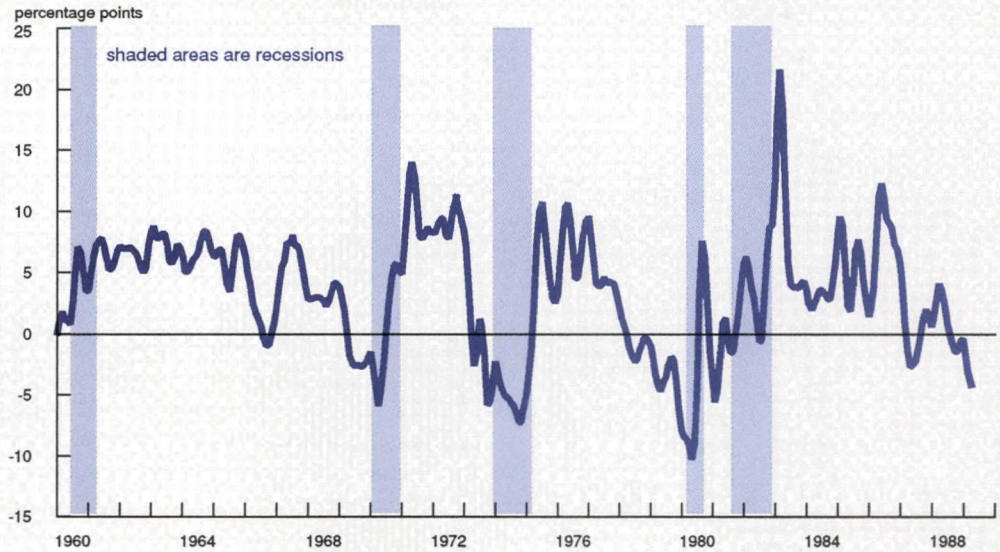
However, a very plausible argument can be made that policy is much tighter than the conclusion given above. The fundamental problem with the analysis above is that it views inversions as a separate class of economic phenomena rather than as particularly severe cases of narrowing interest rate spreads. Nothing magic happens when a spread moves from +1 basis point to –1 basis point to put behavior into an entirely separate class of phenomena. When one looks at all narrowings of the spread one sees that there have even been recessions (e.g., 1957–58, 1960) that were not preceded by inversions of the yield curve. The reason why previous inversions were so deep was that economic conditions at those times were such that a tightening Fed policy needed deep inversions to achieve its objectives. Whether slowing economic growth in the present situation requires a deep inversion or the milder narrowing of the yield spreads seen in other episodes depends on whether current economic conditions are more like conditions of the previous inversions or of the milder narrowings.

It is difficult to briefly differentiate economic environments at separate points in time but Figure 6 shows that the inflation rate is one factor that clearly differs. The last four recessions occurred when the inflation rate was relatively high. Not only was the inflation rate relatively high but the inflation rate at the beginning of each successive recession tended to be higher than in the previous one. It is easy to imagine that each successive episode required a steeper inversion in the yield curve to establish credibility against inflation. If this interpretation is correct, then the present situation with its roughly 5 percent inflation rate, which is well below inflation rates in the early 1980s, is not likely to require a deep inversion to slow the economy.

This interpretation is supported by another observation. Research tends to concentrate on inversions and recessions because they are easily identified. Yet there have been slowdowns in the economy that involved neither recessions nor inversions. Indeed, as described in the second section of this paper, the two most recent slowdowns (1984 and 1986) occurred without either inversions or recessions. These slowdowns occurred after the high-inflation, deep-inversion episodes of the early 1980s, and thus might give valuable clues for the present situation. During the 1984 epi-

FIGURE 5

Percentage increase in real M2 and recessionary periods

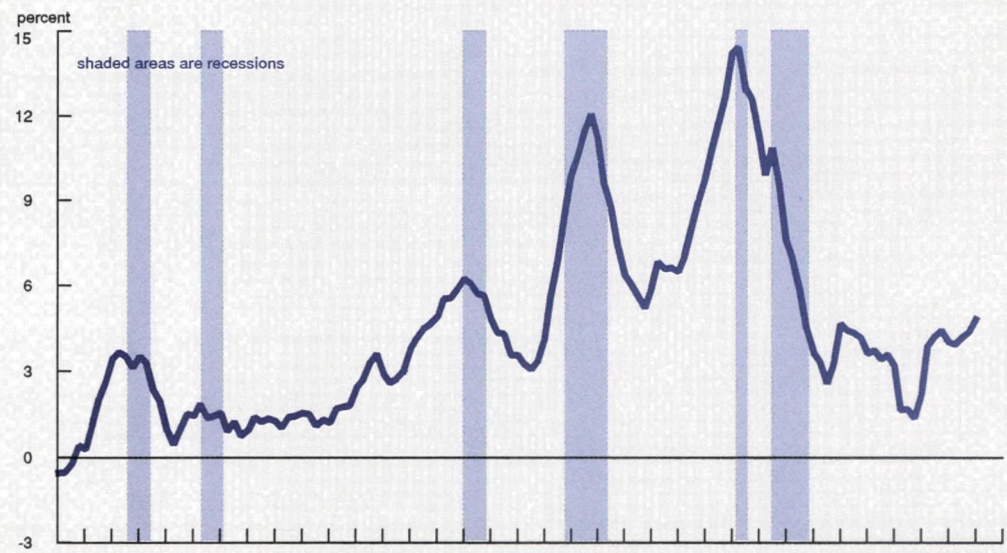


NOTE: The annual rate of change of real M2 over the last three months compared to real M2 in the preceding 3 months using the CPI.

sode, which is most like the present in that the federal funds rate was being raised in an active attempt to slow the economy, the narrowest monthly reading on the spread was +39 basis points in August 1984. The slowest growth in the economy occurred in the fourth quarter when real GNP growth was 1.7 percent. In 1986, a fall in long-term rates narrowed the spread to a low of +18 basis points in March and was followed by a decline of 0.8 percent in real income in the second quarter and growth rates of 1.0 percent and 1.4 percent in the third and fourth quarters of 1986, respectively. When compared with the evidence

FIGURE 6

Change in the CPI and recessionary periods



NOTE: Data are year-over-year changes in the CPI measured quarterly.

from these slowdowns, the recent pattern of spread behavior (in particular the –137 basis point spread of May 1989) suggests that the slowdown in the second half of 1989 will be substantially more severe than would be suggested by only looking at evidence of past deep inversions.[12]

Policy and the spread

Although the model of the spread presented in this review at the beginning of 1988 does not predict future economic activity precisely, evidence from the last six years—including data beyond that used in the earlier study—indicates the spread could still be valuable for monetary policy.

First, because the spread incorporates the fed funds rate, the primary operating instrument through which monetary policy is currently implemented, it would be almost as easy to control as the funds rate itself. Since the bond rate will generally move in the same direction as the federal funds rate, but by a smaller amount, the monetary authority can affect the spread through movements in the federal funds rate, while observing movements in the long bond rate. Interest rates are observed instantaneously and continuously without later being subject to seasonal or other revisions.

Second, the spread helps to solve the fundamental problem confronting any policy implemented through setting an interest rate. It is universally agreed that, other things being equal, increases in the funds rate tighten monetary policy while reductions in the funds rate ease policy. However, other conditions are seldom if ever equal, so that it is difficult for policymakers to know what monetary policy posture is implied by a given level of the federal funds rate.[13] By providing a proxy for other conditions in the form of the long-term bond rate, the spread helps to solve that problem. The description of recent monetary policy in the second section of this paper provides a number of concrete examples of the usefulness of the spread in assessing the thrust of policy on real GNP growth.

Maintaining the same funds rate does not necessarily mean that monetary policy is unchanged. Although the federal funds rate was held constant in late 1985 and early 1986, the strong rally in the bond market indicated that policy was actually tightening, with the consequent slowdown in growth in 1986.

Moving the funds rate does not mean policy is even moving in the direction desired. From March to October 1987, the federal funds rate was raised in an apparent attempt to slow economic growth. However, because the long-term bond rate was rising even more rapidly, monetary policy, as measured by the spread, was actually becoming easier. This fact was reflected in the continued strength in the economy through 1987 and early 1988.

A sharp move in the funds rate may be necessary to maintain the current thrust of policy. In as unique and cataclysmic an event as the stock market crash of October 1987, the spread provided an indication of how much the funds rate would have to move to maintain the policy. Though long-term bond rates dropped sharply in the wake of the crash, the spread indicated that the lowering of the funds rate was sufficient to keep policy from tightening and maintain the same (in this case, expansionary) policy posture.

Third, the roughly two-quarter lag between changes in the spread and the response in real economic growth helps a policymaker set more realistic expectations for policy. The federal funds rate was raised beginning in March 1988 and continued to rise until February 1989. As late as the end of 1988, many observers expressed surprise that, nine months after a tightening in policy began, there were still no significant signs of a deceleration in economic activity. But examination of the data indicates that the spread did not begin to narrow at all until June, and significant narrowing did not occur until August. The two-quarter lag between the spread and economic activity suggests that a slowdown in real GNP growth rate would not typically occur until late in the first quarter, or early in the second quarter, of 1989.

Although the spread, at this point, has not gained the status of a target of monetary policy, private forecasters are increasingly using it as a forecasting tool. Moreover, the likely benefit of using an interest-rate spread in the formulation of monetary policy has led at least one member of the Board of Governors, Manuel Johnson, to include an interest-rate spread in the list of indicators he would use to guide monetary policy.[14]

Conclusion

A deterioration in the relationship between growth in the monetary aggregates and future real economic growth has reduced the usefulness of money growth in the formation of monetary policy. In an article published in this review at the beginning of last year, the spread between a long-term government bond rate and the fed funds rate was suggested as a useful indicator of monetary policy. Although the spread does not precisely forecast future real economic growth, the examination of recent experience indicates that it can be a helpful guide for monetary policy. In one recent instance, the spread clearly predicted that there would be no economic slowdown in the wake of the stock market crash in late 1987. It has more recently indicated that a slowdown in economic growth was likely to begin in the first half of 1989. Viewed in isolation, recent spread data suggests that the slowdown is likely to extend through the rest of 1989 and be quite significant. This scenario is more pessimistic than the current consensus forecast. The economy's performance in the next few quarters will provide an interesting test of the spread.

FOOTNOTES

[1]See Laurent (1988).

[2]The same logic implies that a relationship should, if possible, be tested by forecasting future data after it is formulated, but before it is published. The spread had been formulated in the second quarter of 1986 and its forecasts monitored at the Federal Reserve Bank of Chicago between then and the publication of the article at the beginning of 1988.

[3]The forms of these two equations are taken from Table 3, p. 12 of the earlier article.

[4]Another possibility is to look at the difference between a *real* long-term rate and a *real* short-term rate. See Furlong (1989).

[5]Recall that the fed funds rate is calculated on a bond-equivalent basis.

[6]The Fed was operating with a borrowed reserve target and borrowings were at the minimum frictional level so that the spread between the fed funds rate and the discount rate could not be lowered by reducing the level of borrowings. Under this operating procedure and these conditions a reduction in the fed funds rate required a reduction in the discount rate. For a more complete discussion of this operating procedure see Kasriel & Merris (1982).

[7]The spike in the funds rate at the end of 1986 was an extreme example of a regular year-end pattern of upward blips in the funds rate that are widely recognized as being without policy significance. In the week ended December 31, 1986, the fed funds rate averaged 9.20 percent. When monthly averages were calculated, that week raised the December monthly average substantially, and even raised the January 1987 monthly average somewhat.

[8]Real income data from 1988 are still subject to possible substantial revision. A study by Estrella and Hardouvelis (1989) indicates that a spread does much better forecasting final real GNP data than the first issued data.

[9]The real GNP data adjusted for the drought are used, because the spread operates by affecting demand and could not be expected to forecast a supply shock like a drought.

[10]It should be noted that the average spread over April and May was –128 basis points which, if it were the second quarter average, would imply a 1.5 percent growth rate in fourth quarter real GNP.

[11]For one of the most comprehensive studies of this type see Lieberman (1989).

[12]There are still other indications that the slowdown may be quite significant. The linear regression relationship for the spread has generally overpredicted real GNP growth recently, including the last 5 quarters. Also, Figure 5 shows that the growth rate in real M2 has recently been weak, with the May 1989 figure the lowest since early 1982.

[13]For an excellent description of the problems of conducting monetary policy through interest rates, see Mote (1988).

[14]See Johnson (1988).

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