

Federal Reserve Bank of New York

Quarterly Review

Spring 1988 Volume 13 No. 1

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This Quarterly Review is published by the Research and Statistics Group of the Federal Reserve Bank of New York. Remarks of E. GERALD CORRIGAN, President of the Bank, on a balanced approach to the LDC debt problem, begin on page 1. Among the members of the staff who contributed to this issue are SUSAN HICKOK, LINDA A. BELL, and JANET CEGLOWSKI (on the competitiveness of U.S. manufactured goods: recent changes and prospects, page 7); and JOHN WENNINGER (on money demand—some long-run properties, page 23).

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A Balanced Approach to the LDC Debt Problem

Good morning ladies and gentlemen. I welcome this opportunity to address again the annual meeting of the Bankers Association for Foreign Trade. In saying that, I must confess that it does not seem possible that it was two full years ago when I last spoke to this group in Phoenix. What seems even more improbable is that we will soon enter the seventh year of efforts to cope with the debt problems in the developing world that burst upon the scene in August 1982. In the face of that, I would like to use this occasion to share with you some of my thoughts and observations regarding where we have been and where we are going in the continuing effort to manage and ultimately resolve the debt problem.

The dangers of...a systematic disruption to international trade and finance clearly have been reduced. But the overall situation is still one in which systemic risks are present. Thus, a focus on the "big picture" must remain in the forefront of constructive thinking and progressive actions regarding the debt problem.

I believe a useful starting point in that exercise would be to review briefly just what has—and has not—been accomplished over the past six years. Retrospective review is always useful, but in this case it is especially important because it reveals that far more has been achieved than is widely recognized. Accordingly, allow me to briefly highlight some of the accomplishments of

Remarks by E. Gerald Corrigan, President of the Federal Reserve Bank of New York, before the 66th Annual Meeting of the Banker's Association for Foreign Trade, April 25, 1988.

the effort to date and then mention some of the areas in which progress has not been as great as we would have liked:

Debtor countries have made some very important strides in improving their economic policies and their economic performance against very strong countervailing forces. To be sure, that progress has been uneven and in some respects disappointing, but the setbacks and disappointments should not distract our attention from the gains that have been made.

First, and we should never forget this, in the early days of the debt crisis only swift, decisive, and broadly based cooperative efforts by debtors, creditors, central banks, governments and multilateral institutions allowed us to avert financial and economic calamity. Since that time, the dangers of such a systematic disruption to international trade and finance clearly have been reduced. But the overall situation is still one in which systemic risks are present. Thus, a focus on the "big picture" must remain in the forefront of constructive thinking and progressive actions regarding the debt problem.

Second, debtor countries have made some very important strides in improving their economic policies and their economic performance against very strong countervailing forces. To be sure, that progress has been uneven and in some respects disappointing, but the setbacks and disappointments should not distract our attention from the gains that have been made. Let me cite a few specifics to back up that point and in so doing

I will focus mainly on a group of eight troubled debtor countries where U.S. bank exposure is the largest. Those countries are Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, the Philippines, and Venezuela.

- For these countries, there has been a significant improvement in aggregate trade and current account positions despite the fact that virtually all have experienced devastating setbacks in the terms of trade during the period in question. For example, in 1982, the aggregate current account deficit of the eight countries was almost \$40 billion; in 1987, it was about \$5 billion. To fully appreciate the nature and scope of this adjustment, just contemplate for a minute the difficulties we in the United States are having in making external adjustments, which in relative terms are much smaller than the adjustments these developing countries have made.
- Growth in GDP and per capita GDP has reemerged even if at slow and sporadic rates. In three of the countries—Chile, Colombia, and the Philippines—recent growth patterns in the context of inflation performance are distinctly better. In addition, renewed initiatives in the area of both macro and structural policy should work in the direction of improved prospects elsewhere. In another case, that of Mexico, the tremendous growth in non-oil exports and the build-up in official reserves have been particularly striking, especially in the context of continuing efforts on the policy front.
- The key ratio of external interest payments to exports is falling in virtually every country and for a majority of the eight that ratio is now below 30 percent, while for three the ratio is in the low 20 percent range.
- Important but not yet decisive steps are also being taken by the countries in the move toward more open and more competitive economies. Trade policies are becoming more liberal; some state enterprises are being divested as elements of privatization begin to take hold; the institutional environment for foreign direct investment is improving—a process that has been spurred in part by the success of debt equity swaps in countries such as Chile; and direct and indirect subsidies on a wide range of goods and services are being reduced or eliminated.
- Finally, considering the economic environment of the past six years—that is, one in which cyclical forces would be expected to swell public sector deficits—some debtor countries have made important strides in reducing public sector deficits as a percentage of GDP. Here too, progress has been uneven and, on balance, deficits are still too large, but the direction of movement over time is generally right and in some cases the amount of the adjustment is significant.

Third, on the financial side, the scope of the overall debt restructuring effort has been remarkable. Just think of it: more than \$200 billion of existing debt has been restructured to the *mutual benefit* of debtor and creditor alike, and in the process countless innovations have been introduced into the terms and conditions of the restructured debt. These developments suggest to me that there is still ample room for further innovation that is consistent with the time honored precept of debtors and creditors working together to forge voluntary and mutually beneficial solutions to their problems.

Fourth, the commercial bank new money process has also worked reasonably well in that over the 1983-87 period the international community of banks has committed to lend almost \$45 billion in fresh money to the Baker 15. The new money process has also been enhanced by its own adaptations and innovations, but there is a question in my mind—to which I will return later—as to whether we can be satisfied with the status quo as it applies to the new money financing process by the commercial banks—a process that remains a central and indispensable element to ultimate success in this overall effort.

On the financial side, the scope of overall debt restructuring effort has been remarkable. Just think of it: more than \$200 billion of existing debt has been restructured to the *mutual benefit* of debtor and creditor alike, and in the process countless innovations have been introduced into the terms and conditions of the restructured debt.

Finally, and certainly not inconsequentially, the past six years have witnessed a dramatic reduction in bank exposure to the troubled LDCs. For example, for any cross section of the very largest U.S. banks, exposure to the Baker 15 relative to primary capital in 1982 was in the range of 225 to 250 percent. Reflecting primarily the enormous growth in primary capital at these banks in recent years, these ratios at year-end 1987 were in the range of 80 to 90 percent, despite the fact that the major U.S. banks have been, and should be, among the leaders in providing new money to the debtor countries. The current exposure ratios, however, are still too high but also are still declining as capital grows and as individual banks utilize various bilateral and voluntary techniques to reduce exposure. It should also be stressed that reductions in bank exposures have been aided by limited but not unimportant amounts of outright debt repayments as, for example, in the case of Colombia and Venezuela and on the part of private debtors in many countries.

In the interests of time, I don't want to belabor the

point, but I do want to emphasize that a great deal has been achieved on many fronts over the past six years. Some would suggest that this period has simply been an interval of "muddling through" and little more has been done other than to buy time. I simply don't see it that way. To be sure, time has been bought, but it has not been wasted in that clearly we are closer to lasting solutions now than we were a year, two years, or six years ago, even if it remains true that the process will still take time—a lot of time.

In pointing to the progress that has been made, we must also be realistic in recognizing that from the perspective of the debtor countries that progress has been exacted at a high cost in both political and economic terms. Let us also not lose sight of the fact that clear problems remain: inflation performance, especially in the largest debtors, has been a major disappointment; the levels of debt relative to GDP or to exports have not come down and in most cases have actually increased; major structural impediments to more open and more efficient economies remain; frustration and fatigue are at high levels; the need for greater adaptability in the approaches of the multinational institutions is apparent; and, in an ironic and worrisome way, the new money commercial bank financing process has been weakened in part because bank exposures have been reduced so dramatically.

In looking at the overall [debt] situation, it is clear that we are at something of a crossroad in that we face the crucial question of how best to sustain the progress of the past while dealing with the shortcomings that have emerged over the past several years.

Indeed, if we needed a reminder of the remaining problems, the Brazilian moratorium provided evidence of the vulnerabilities. Fortunately, Brazil has concluded that the moratorium was not in its interests and is now in the process of seeking to normalize relationships with all of its creditors, a process that hopefully can be completed in the weeks immediately ahead. Regrettably, we have also seen a case or two in which a country has chosen to attempt to "go it alone." However, when I look at the results of those experiments, they seem to me to provide striking support for the wisdom of the more conventional and cooperative approach.

In looking at the overall situation, it is clear that we are at something of a crossroad in that we face the crucial question of how best to sustain the progress of the past while dealing with the shortcomings that have emerged over the past several years. Some have suggested that the way for the future lies in some sweeping and generalized approach that would incorporate—one

way or another—a program of debt relief, debt forgiveness and/or the shifting of commercial bank debt to the official sector. I do not share that view and I say that for a number of reasons.

The outright shifting of even a part of the commercial bank debt to the official sector is—among other things—plainly a political nonstarter.

For one thing, the outright shifting of even a part of the commercial bank debt to the official sector is—among other things—plainly a political nonstarter. That, of course, is not to say that the multilateral institutions should not play an enlarged role as, for example, is contemplated by the broad thrust of the Baker Plan. Nor is it to suggest that the creditor governments do not have a role to play in helping things along. But there clearly are limits as to how much the official sector can and should do, and any realistic assessment of those limits implies that the commercial banks must remain an essential part of the solution.

It is also true that anything approaching a "forced" write-down of even a part of the debt—no matter how well dressed up—seems to me to run clear risks of

Anything approaching a "forced" write-down of even a part of the debt—no matter how well dressed up—seems to me to run clear risks of inevitably and fatally crushing the prospects for fresh money financing that is so central to growth prospects of the troubled LDCs and to the ultimate restoration of their credit standing.

inevitably and fatally crushing the prospects for fresh money financing that is so central to growth prospects of the troubled LDCs and to the ultimate restoration of their credit standing. But that risk is one that applies not only to current troubled debtors but to others as well. For example, what entity—private or public—would be willing to risk its capital in lending to any country if the lending entity concluded there were risks that political forces might, at some later date, require the creditor to accept losses to its shareholders or to those for whom it has fiduciary responsibilities? You may answer that question in your own way, but I, for one, am hard pressed to imagine how such an approach could work in a constructive fashion. Indeed, I find it wholly unrealistic to assume that creditors would take forced losses and then turn around and extend new credits, even if such new credits were senior to the old credits.

I find it equally unappealing to run the risk that the

process of attempting such an approach might trigger a wholly unacceptable series of actions on the part of creditors or debtors or both that could be highly destabilizing. Even now, many bank creditors are unwilling to extend new money in a setting in which the bulk of existing debt has been and is being serviced at positive interest rate spreads.

Finally, and perhaps most importantly, generalized approaches to debt relief or forgiveness seem to me to also work the wrong way in terms of incentives in the debtor countries. That is, even the specter of some generalized form of debt relief can carry with it the illusion that the burden of policy adjustment and adaptation is lessened or removed. To the extent that occurs, conditions could actually worsen and the slippery slope of debt relief will become very slippery indeed. In other words, once the process starts, what is to stop it?

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In the final analysis, the task before us is one that requires that we carefully weigh and balance the risks and rewards of alternative courses of action. In turn, that seems to me to require that we have some criteria against which we can systematically look at the advantages and disadvantages of alternative courses of action.

I have previously suggested a general framework that I believe has value in this regard. Specifically, as I see it, today, as a year ago or five years ago, or for that matter a year or several years into the future, there are certain fundamental prerequisites that must be a part of any constructive effort to forge a permanent solution to the LDC debt problem. Those prerequisites include the following:

First, growth in the debtor countries in the 5 percent range that they have all experienced in the past must be sustained over a period of time.

Needless to say, achieving that result presupposes appropriate macro and micro policies on the part of the debtor countries. It also requires an international environment conducive to LDC export growth, which means policies for noninflationary growth in the creditor nations and a strong and continuing commitment to free and open trade on the part of all.

Second, the maintenance by the LDCs of businesslike relationships with their creditors, which means the timely

servicing of financial obligations. In that regard, in a context in which a country has an established track record of servicing its obligations, innovative steps such as the *voluntary* Mexican debt repurchase plan can play a constructive role, especially if such efforts are viewed essentially as exit-type vehicles. But here too we must be realistic. Such efforts can be a constructive step in appropriate circumstances, but no more than that. They are not, nor will they ever be, either a substitute for the willingness and ability of debtor countries to service their debts or a sustainable channel for needed financing.

Third, a reasonably stable and predictable flow of appropriate amounts of official and commercial bank credit to the LDCs must be maintained. Approaches to the LDC problem that fail to take explicit account of the need to provide new financing—including private financing—to the LDCs over time should be viewed with skepticism. At the extreme, a debt strategy that cannot hold out the hope of renewed debtor access to market sources of external finance is no strategy at all. The object of the exercise is to restore creditworthiness and confidence, not to further impair them.

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Fourth, strong and well-funded multilateral official institutions are central to the process not only because they can provide the added financing needed to close external financing gaps in the LDCs but also because they and they alone can be the locus of policy coordination and conditionality—a process that should become more flexible but that remains a crucial ingredient for success.

Fifth, an appropriate degree of solidarity and commonality of purpose among private bank creditors, and especially major bank creditors, must be maintained.

These prerequisites are a package deal. Success in any one or two or four is not good enough; true and lasting success will be found only if we have progress on all five fronts. Indeed, the great problem with many of the alternative schemes that one can conceive is that they can be quite responsive to one or even several of these prerequisites but miss the mark rather badly on others; that's not good enough. We need to make simultaneous progress on all.

Having stated these prerequisites, and having earlier pointed to what has and has not been achieved over the past several years, let me now conclude with a few comments on some steps that I believe can help to ensure continuing progress in the period immediately

ahead.

Turning first to the LDCs, there is no question in my mind that the only real solution to the debt problem is for the countries to grow out of the problem over time. There is also no question in my mind that such a solution can work—even though it cannot be expected to be a straight line—but it can work only in the context of sound policies. There is no magic to it; good economic performance rests on good macroeconomic policy. In the case of the LDCs, however, it is more and more clear that macro policy must be complemented by even greater emphasis on the structural side. And, within that broad area, I believe that there is much to be said for efforts aimed at greater strides in the direction of privatization and—consistent with national interests—reductions in the size and role of state-owned enterprises. I sense that greater efforts in that direction may be especially valuable for several reasons: it can aid the financing process; it can surely aid the cause of greater efficiency and competitiveness; and it may also be true that it can help reduce budget deficits and minimize some of the structural pressures on domestic price inflation.

Good economic performance rests on good macroeconomic policy. In the case of the LDCs, however, it is ... clear that macro policy must be complemented by even greater emphasis on the structural side.

In other words, I'm suggesting that there may be potentially large paybacks to the debtor countries stemming from greater effort to reduce the size and scope of state-owned enterprises, even though I am obviously sensitive to the political problems that can be encountered in such an effort. I am even more sensitive to the fact that there is a point beyond which that process cannot go. But, within those constraints, I would hope more can be done in this area for the reasons I have cited but also because greater progress in this area can help ease the burden on macro policies. Finally, I have to wonder whether it is possible that such efforts might not help stimulate capital repatriation—the ultimate pot of gold at the end of the rainbow!

With regard to the multilateral official institutions, there are several near-term priorities. The first is seeking to put in place the much needed general capital increase for the World Bank. That will not be easy, but if the World Bank is to play an enlarged role in helping to manage the debt problem, as all observers seem to agree it must, the general capital increase is a must.

In the case of the IMF, the areas of greatest priority

—greater flexibility and a longer perspective—are currently being addressed in that a variety of important adaptations in the financing programs and monitoring techniques of the Fund are under active consideration. Indeed, the prospect of multiyear financing facilities, financing facilities to help guard against certain external contingencies such as rising interest rates, and greater flexibility in the use of performance indicators seem to me to be important steps in the direction of a stronger and more flexible role for the Fund that should be welcomed by both the debtor countries and the private creditors.

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The commercial bank financing aspect of the debt problem must also be strengthened. The menu of options has already been broadened, but what we need is not a menu but a smorgasbord that can appeal to the increasingly diverse needs and desires of individual banks and individual countries. But—and I want to emphasize this point strongly—even the most imaginative steps in that direction will not be enough given the prerequisites I cited earlier and given the increasingly divergent attitudes and behavior among segments of the commercial bank creditors. In that regard, the one thing we do not need is to have the debt problem again take on the characteristics of a debt crisis because of a crisis among the creditors.

To avoid that, we need a strong reaffirmation of the commitment of the creditor banks to the bigger picture; we also need to see decision making at the Advisory Committee level expedited and driven more by policy consideration and less by legalities and technicalities. Finally, we must find a solution to the so-called free rider problem in which an increasingly large number of banks refuse to participate in the new money lending but get the benefit of the process in the form of interest payments on existing loans. If nothing else, equity considerations point to the need for a solution to this problem. But far more is involved than equity considerations. Thus, I believe the time has come for the direct parties to the process to get serious about workable and effective approaches to exit-type vehicles, which of necessity will have to entail some cost to those who choose to exit. While it is not my role to suggest what form such vehicles should or might take, I do want to stress that they should emerge as a part of the continuing process of cooperation between the debtors and the private creditors.

I apologize for starting off your meeting with such a

long and complex speech, but as I said at the outset, much is at issue here. How we respond to the next phases of efforts to manage and ultimately resolve the debt problem remains one of the great issues of the day

in the arena of international trade and finance. I remain confident that we can see it through successfully, but that will take vision and, as symbolized by this speech, it will take time.

The Competitiveness of U.S. Manufactured Goods: Recent Changes and Prospects

The decline in the international competitiveness of U.S. manufactured goods over most of the past decade has been much discussed. U.S. goods lost significant market share both at home and abroad. Declining manufacturing competitiveness contributed to record current account deficits, falling manufacturing employment, and almost stagnant real compensation growth for manufacturing employees.

A prime factor accounting for the decline in U.S. competitiveness was a large deterioration in the relative price position of U.S. goods.¹ The steep appreciation of the U.S. dollar between 1979-85 led to sharply rising U.S. costs and prices in comparison to those abroad. Slower growth in U.S. domestic costs and prices offered only a modest offset to the negative price effect of dollar appreciation. Weak growth in manufacturing productivity until 1982 compounded U.S. problems.

At the same time that overall dollar prices were becoming less favorable for the United States, U.S. competitiveness also suffered from significant quality problems in a number of important industries. Manufacturing competitiveness was weakened by a growing international disenchantment with the caliber of U.S. products. Although many goods maintained their strong performance reputations, sufficient questions were raised about the quality of other products to account for perhaps as much as one-quarter of the loss of U.S. com-

petitiveness over the period 1979-86.

More recently, however, major changes have occurred, strengthening the price/cost and quality position of U.S. manufacturing. U.S. relative prices have improved sharply. This improvement reflects the steep depreciation of the dollar since 1985, continued U.S. domestic cost restraint, and a dramatic rise in U.S. productivity that started in 1982. U.S. competitiveness has been further bolstered by a substantial improvement in the quality performance of a number of important U.S. products and the introduction of significant quality control measures across the broad spectrum of U.S. manufactured goods.

This paper explores these recent favorable changes in the competitiveness of U.S. manufactured goods. It first considers the extent to which U.S. price and quality performances have improved, focusing on the effects of exchange rate movements, cost restraint, productivity increases, and quality control efforts. The paper then analyzes in more detail how certain underlying factors—investment levels, technology/research and development expenditures, industrial restructuring, and work reorganization—have changed, promoting the improvement in the U.S. position. Finally, the paper discusses the implications of recent and expected changes in these underlying factors for the competitiveness of U.S. manufactured goods over the next several years.

Recent competitiveness changes

Price performance: exchange rates and domestic costs
Performance relative to other industrial countries: After losing significant price competitiveness to major foreign industrial countries during the early 1980s, U.S. manufacturers

¹For a detailed accounting of the factors causing the decline in U.S. competitiveness over both the 1973-86 and 1979-86 periods, see Susan Hickok, Linda Bell, and Janet Ceglowski, "U.S. Manufactured Goods Competitiveness: Recent Changes and Future Prospects," Federal Reserve Bank of New York, Research Paper no. 8801, February 1988.

experienced a sharp reversal in their relative price position in the last two years. For the period 1980-85 the price of foreign manufactured goods fell on average 5 percent a year relative to U.S. prices when measured in dollar terms. But in 1986 U.S. prices fell 17 percent on a year average basis against competing foreign industrial country prices (Chart 1).² U.S. prices continued to improve in 1987 as well, regaining their pre-1980 competitive position on a year average basis. By December 1987 U.S. prices were actually about 10 percent more competitive than they had been at the end of 1979.

Both exchange rate changes and domestic price movements, backed by changes in domestic input costs and productivity levels, accounted for this improvement. Exchange rate changes had the most obvious effect.

²This change in relative prices measured in U.S. dollar terms is computed by combining changes in respective wholesale price indexes with changes in exchange rates. Using GNP deflators instead of wholesale price indexes gives essentially the same results. Average foreign prices are a weighted average of Canadian, Japanese, German, French, British, and Italian prices. Weights are determined by an equal combination of each country's imports as a share of U.S. exports and each country's imports as a share of world exports.

Since mid-1985 the dollar has depreciated 30 percent against major foreign currencies, a decline that totally reverses the 30 percent depreciation of these foreign currencies against the dollar during the period from 1980 to early 1985.

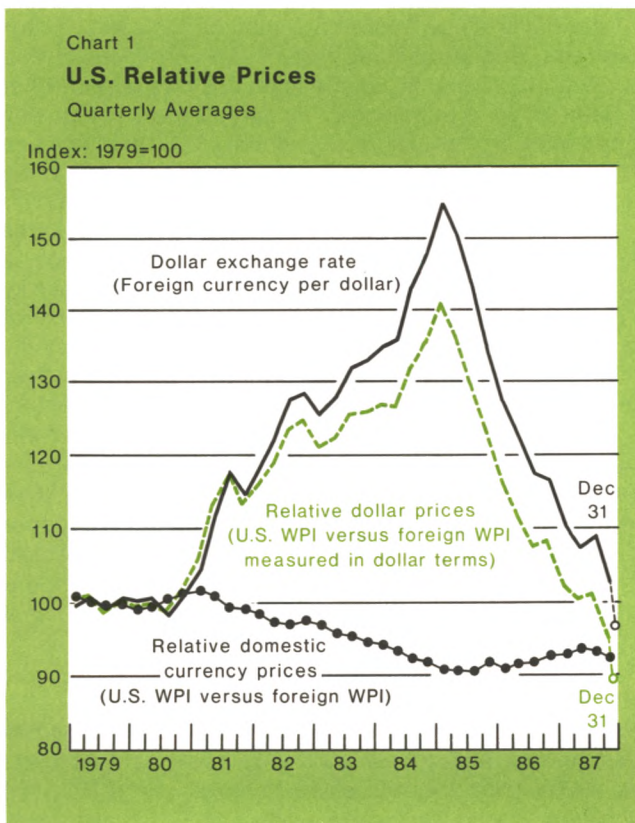
Also affecting U.S. price competitiveness critically in the 1980s, albeit less dramatically, were changes in the price levels of manufactured goods measured in local currency terms in different industrial countries. Despite starting the 1980s at a higher rate than the average rate abroad, U.S. price inflation was significantly lower than average foreign inflation for the 1980-87 period as a whole. The greater moderation in U.S. inflation mitigated to some extent the negative competitiveness impact of dollar appreciation during the 1980-85 period. And by the beginning of 1988, with the dollar returned to its pre-appreciation level, it was the movement in relative domestic prices that placed the United States in a 10 percent stronger price competitive position than at the start of the decade.

Input price movements, especially restrained U.S. wage growth, were important contributing factors to the more subdued movement of U.S. domestic prices during recent years. Over the 1980-87 period U.S. hourly compensation rates for manufacturing employees, which account for about 60 percent of the cost of manufacturing production,³ grew on average only 5.7 percent a year, compared to an average annual foreign rate of about 8 percent (Table 1). Although both U.S. and foreign wage growth slowed markedly as the 1980s progressed, U.S. growth remained significantly below that abroad. The positive effect of wage restraint on U.S. cost is evident in a comparison of average hourly dollar compensation levels in the United States with foreign compensation levels. At the end of 1987 the dollar was back to its beginning 1980 level. End-1987 U.S. hourly compensation, however, was only slightly above average compensation abroad, in sharp contrast to its large differential in 1980.⁴

Capital costs, which along with return on investment account for about 20 percent of the cost of production, also moved in favor of U.S. price competitiveness over the last three years. The recent moderation in capital costs, however, only offset an unfavorable movement in these costs during the early 1980s. The major and most volatile component of relative marginal capital costs has

³Input shares are derived from 1977 input-output tables for the United States reported in the *Survey of Current Business*, May 1984 and November 1985.

⁴Wage restraint, of course, came at the expense of the relative living standards of manufacturing employees. Improved living standards are a major goal of the overall competitiveness effort. Despite this negative effect, wage restraint did improve the price position of U.S. goods in relation to that of foreign goods during the 1980s.

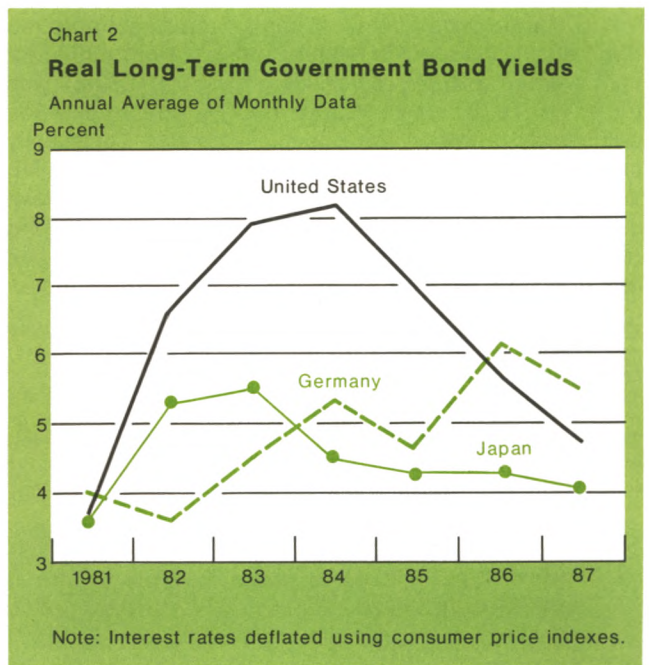


been the real interest rate level.⁵ After moving sharply above average foreign real interest rates during the early 1980s, U.S. real interest rates fell significantly in the mid-1980s, reaching average foreign levels by 1986 (Chart 2). They remained in line with foreign levels in 1987.

The cost of raw materials, the third input in manufacturing production, was the only factor working against U.S. price competitiveness in recent years. Raw materials account for about 20 percent of the cost of manufacturing production. The price of these materials is set in global markets and rises in dollar terms about equally with the level of dollar depreciation,⁶ although the effects of the increase may not be felt immediately because of long-term contracts and inventories. As a consequence of the recent sharp depreciation of the dollar, raw material costs in the United States rose relative to costs in countries whose currencies have been appreciating against the dollar. This development offset slightly the

⁵Evidence supporting this point can be found in Table 2 of A Historical Comparison of the Cost of Financial Capital, U.S. Department of Commerce, International Trade Administration, April 1983, p. 3.

⁶A. Steven Englander, "Commodity Prices in the Current Recovery," this *Quarterly Review*, vol. 10, no. 1 (Spring 1985), pp. 11-19.



price competitiveness benefits provided by dollar depreciation.

Overall, input price movements clearly benefited U.S. price competitiveness. Competitiveness gains also resulted, however, from very strong improvement in U.S. manufacturing productivity. Productivity measures the amount of output produced by a given amount of input. The higher the productivity level, the greater the output that can be produced at a given input cost. Consequently, higher productivity levels mean that manufacturers can lower the price charged per unit of product while still covering the cost of production inputs.

The performances of labor and capital are closely linked in the production process. When labor has a larger or more efficient stock of capital equipment to work with, measured labor productivity (output per man-hour) is higher. Similarly, when labor is more efficient, measured capital productivity (output per unit of capital) is higher. It is very difficult to separate completely growth in labor productivity from growth in capital productivity. This difficulty is compounded by the more basic problem of measuring a unit of capital. For these reasons, productivity figures are generally reported in terms of labor productivity, with the understanding that these figures reflect both labor and capital factors. This reporting practice is reasonable because capital productivity normally changes only slowly as new pieces of equipment are added to the existing capital stock.

Table 1

Hourly Compensation in Manufacturing

	United States	Foreign Industrial Countries*	Germany	Japan
Average annual growth in local currency terms†				
1974-79	9.5	13.9	9.5	12.8
1980-87‡	5.7	7.9	5.6	4.6
1980-85	6.9	9.2	6.0	5.0
1986-87‡	2.3	4.3	4.7	3.1
Level of hourly compensation in U.S. dollars§				
1980	9.84	8.48	12.33	5.61
1985	12.96	8.56	9.56	6.47
1987 average‡	13.50	12.50	14.00	9.75
1987 year-end†//	13.50	13.25	15.50	11.00

*Trade-weighted average of Canada, France, Germany, Italy, Japan, and the United Kingdom. See text footnote 2 for description of weighting.

†All manufacturing employees.

‡1987 foreign figures are FRBNY estimates based on reported (although not strictly comparable) wage growth rates in foreign countries.

§Production workers.

//1987 average converted at year-end exchange rates.

Source: Bureau of Labor Statistics

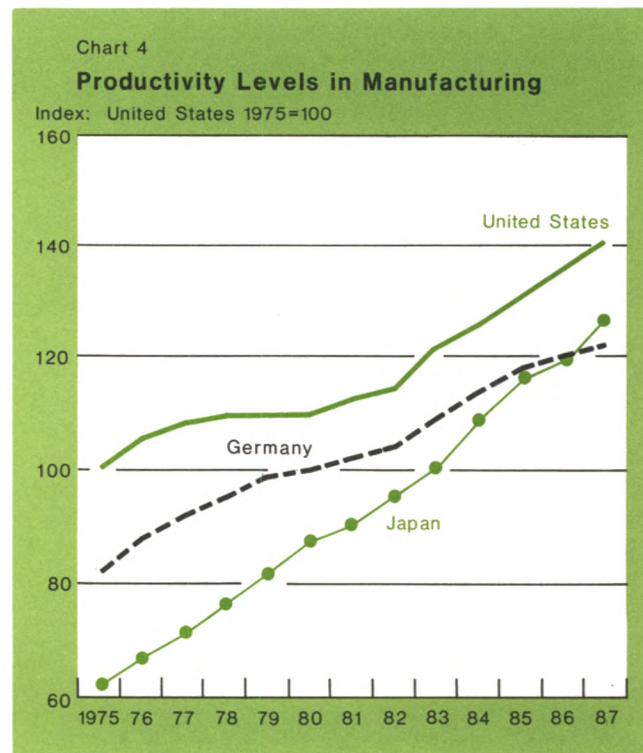
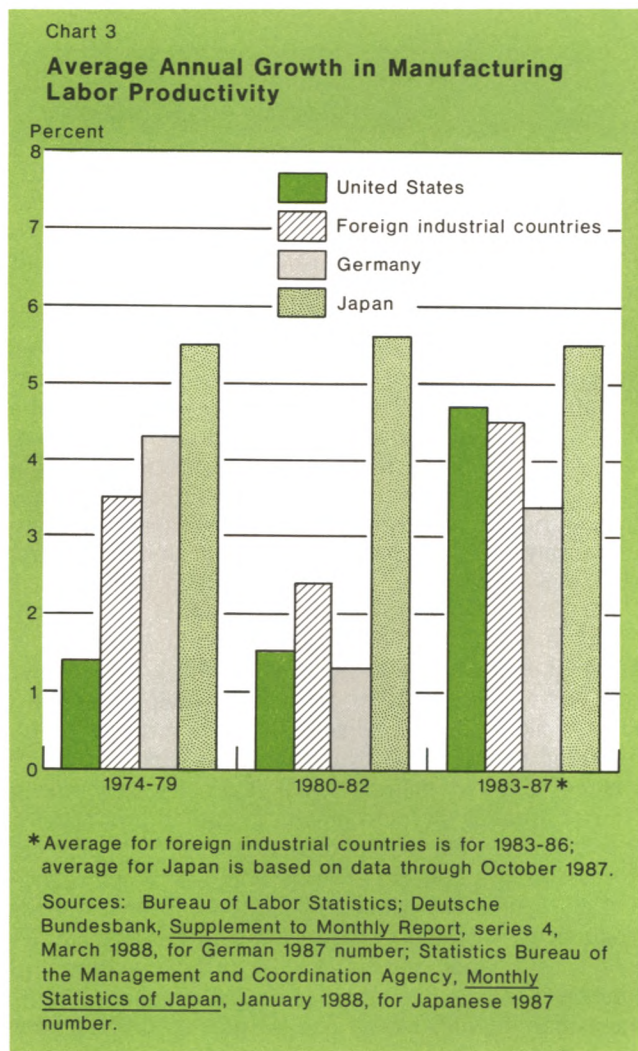
U.S. labor productivity in manufacturing improved dramatically during the 1980s, notably from mid-1982 on.⁷ Average annual productivity growth for 1983-87 was triple its 1970s level (Chart 3). By the mid-1980s productivity growth in the United States was significantly outstripping productivity growth abroad after having substantially lagged it through the 1970s and even during the early 1980s. As a consequence of its strong recent growth, the actual level of U.S. productivity has remained significantly above that of other major indus-

⁷Especially encouraging for a broad-based improvement in U.S. competitiveness was the distribution of the recent U.S. labor productivity growth across manufacturing industries. Durable manufactured goods industries, the laggards in productivity growth in the 1970s, experienced especially sharp productivity advances in the 1980s. In fact, recent productivity growth in these industries set a record for the post-World War II period.

trial countries (Chart 4). In fact, a translation of relative productivity levels into more concrete terms implies that output produced in about one hour of labor time in the United States last year required almost one hour and ten minutes of labor time in both Germany and Japan.⁸

The combination of strong productivity performance, substantial wage restraint, and recent dollar depreciation has made the United States very competitive in terms of unit labor costs (labor costs per unit of output). U.S. unit labor costs have risen only very moderately for the 1980s as a whole and have actually fallen in recent years as productivity has rebounded (Table 2). U.S. output that required \$100 in labor costs in 1980 cost only about \$105 in 1987. In 1980 this same output cost about \$120 in labor costs in Germany and \$65 in labor costs in Japan. In 1985, when the dollar reached its peak appreciation level against most foreign currencies, German and Japanese unit costs fell to about \$80 and \$60 respectively while U.S. costs averaged \$110. But

⁸These figures are based on value added in manufacturing, converted into U.S. dollars at purchasing power parity exchange rates, divided by manhours worked in 1975. Figures for 1987 are derived by applying productivity growth rates provided in the sources cited in Table 2. Purchasing power parity exchange rates are from Irving Kravis, Alan Heston, and Robert Summers, *World Product and Income* (Baltimore: Johns Hopkins University Press, 1982), p. 22, Table 1-10, column 7.



by 1987, following substantial dollar depreciation, German costs averaged about \$140 and Japanese costs averaged about \$100. By year-end 1987 further dollar depreciation brought the German cost to over \$150 and the Japanese cost to about \$115.⁹

In sum, the dominating factor shaping the path of U.S. price/cost competitiveness in relation to other industrial countries from 1980 until 1987 was the movement in exchange rates. However, by year-end 1987 these exchange rate movements had canceled themselves out,

⁹These calculations are based on hourly compensation in manufacturing divided by output/manhour (described in the preceding footnote). All calculations were done for 1975. Figures through 1986 for Germany and Japan and through 1987 for the United States were derived by applying Bureau of Labor Statistics growth rates for unit labor costs measured in dollar terms. Foreign figures for 1987 are based on reported 1987/1986 unit labor cost growth by Germany and Japan adjusted for exchange rate changes. End-1987 figures reflect end-year exchange rate changes. All figures should be regarded as approximations given the problems of obtaining strict comparability of data across countries. Similar results for 1980 were derived using slightly different methodology in Nigel Gault, "The Competitiveness of U.S. Manufacturing Industry: International Comparisons of Labor, Energy, and Capital Costs," Data Resources, Inc.

leaving changes in relative domestic price levels the final determinant of shifting price competitiveness positions over the seven years as a whole. Input price movements, specifically wage costs, and productivity growth rates each played a significant role in charting the course of changes in relative domestic price levels. Together these two factors left the United States in a very strong price competitive position in relation to other major industrial countries at the start of 1988.

Performance relative to developing countries: U.S. prices have become more competitive relative to those of developing countries in recent years. The major developing country competitors in the manufactured goods market have been the four Asian economies: Taiwan, South Korea, Hong Kong, and Singapore. These four economies account for most of the competitiveness gain, measured in terms of market share, of developing countries in relation to the United States since 1979.

Recent exchange rate movements have improved U.S. price competitiveness relative to these four Asian economies. Over the last two years, the currencies of all but Hong Kong appreciated against the U.S. dollar (Table 3). In Taiwan's case the appreciation was quite sharp. Both the Taiwanese and Singaporean currencies are now higher in value against the U.S. dollar than they were at any other time during the 1970s or 1980s.

It is more difficult to compare domestic currency price movements in these Asian economies and in the United States. Generally higher weight is given to the falling price of refined petroleum in the Asian price indexes than in the U.S. price index. Despite this difference, the combined impact of reported relative price movements and exchange rate changes still suggests that the United States moved significantly closer to its early 1980s price competitiveness position relative to these Asian economies in recent years (lower half of Table 3), reversing a sharp competitiveness deterioration earlier in the 1980s.

Quality performance

Improvement in relative quality characteristics in recent years has also had a favorable effect for U.S. competitiveness. Quality characteristics include product reliability, durability, and technological sophistication, as well as product requirements for maintenance, servicing, and delivery time. Problems in these areas are important because they affect not only purchaser satisfaction and demand; they also tend to raise costs. It has been estimated that the typical U.S. factory spends 20-25 percent of its operating budget finding and fixing defective products.¹⁰ This estimate does not include the cost of repairing products after they have been shipped

¹⁰"The Quest for Quality," *Business Week*, June 8, 1987, p. 32.

Table 2
Unit Labor Costs

	Growth in Unit Labor Costs in Local Currency Terms		
	1974-79	1980-86	1987
United States	8.0	3.2	-1.9
Foreign industrial countries*	10.1	5.2	
Germany	4.9	2.8	2.9
Japan	6.8	-0.8	-2.2

	Growth in Unit Labor Costs in U.S. Dollars		
	1974-79	1980-86	1987
United States	8.0	3.2	-1.9
Foreign industrial countries*	10.1	2.0	
Germany	4.9	0.6	24.4
Japan	6.8	3.0	19.1

	Approximate Relative Unit Labor Cost Levels in U.S. Dollars			
	1980	1985	1987 Average	1987 Year-End
United States	100	110	105	105
Germany	120	80	140	155
Japan	65	60	100	115

*Trade-weighted average of Canada, France, Germany, Italy, Japan, and the United Kingdom. See text footnote 2 for description of weighting.

Source: Bureau of Labor Statistics; Deutsche Bundesbank, *Supplement to Monthly Report*, series 4, March 1988, for German 1987 growth rate; Statistics Bureau of the Management and Coordination Agency, *Monthly Statistics of Japan*, January 1988, for Japanese 1987 growth rate. Unit labor cost levels are derived as described in text footnote 9.

from the factory. Quality problems also require maintenance of larger inventories with resultant increases in inventory costs.

Although data on costs and productivity for the United States and foreign countries are readily available, it is more difficult to find information about the relative quality of products across countries. However, cross-country quality appraisals do exist for eleven broadly defined industry groupings during the 1980s, and these show very generally how well the United States has competed in quality terms over the past few years. (Specifics of these quality appraisals are given in the Appendix.) The eleven broad industry groupings—automobiles, paper, steel, electronic parts, pharmaceuticals, construction equipment, consumer electronics, machine tools, electric power generating equipment, textile machinery, and general aviation aircraft—accounted for about 15 percent of U.S. manufactured goods output, 15 percent of U.S. manufactured goods exports, and 27 percent of U.S. manufactured goods imports in 1986.

Quality problems in U.S. products were found in five of the broad industries. However, two of these five industries had eliminated their quality deficiencies by the end of the appraisal period. U.S. quality was perceived superior to that of foreign competitors in four other industries. For the remaining two industries, U.S. quality was judged superior for some products but inferior for others.

Collectively, these results suggest that the United States had an average quality rating in the early 1980s, with some quality improvement as the decade pro-

gressed. Particularly significant for declining U.S. competitiveness in the early 1980s and increasing U.S. competitiveness in recent years was the finding that both quality problems and quality improvement appeared in some of the largest U.S. industries. For example, quality problems were recently overcome by U.S. steel and electronic parts producers, two industries that together account for 4 percent of U.S. manufactured goods output.

Anecdotal evidence also suggests a significant improvement in the quality performance of U.S. manufactured goods in recent years. The U.S. automobile industry, a major producer facing quality problems, has launched a concerted drive to boost its quality reputation. Quality control procedures have also been upgraded in many companies. Statistical methods of quality control, in particular, have gained substantial popularity.¹¹ These methods apply sophisticated statistical techniques to determine exactly where defects are originating in the many separate steps that go into producing a typical finished manufactured product. Increasing use has also been made of computers to "design out" quality defects when products are first created. In part for this reason, the use of computer-aided design (CAD) and computer-aided manufacturing (CAM) systems increased 400 percent from 1981 until 1986.

Additional evidence of recent quality emphasis in U.S. manufacturing comes from manufacturers' comments

¹¹Major firms using statistical quality control procedures include AT&T, Corning Glass, DuPont, Ford, Hewlett-Packard, IBM, Kodak, and Westinghouse. See "The Quest for Quality," p. 32.

Table 3

Recent Changes in Asian Exchange Rates and Export Unit Values in U.S. Dollar Terms

Period Average Levels

Exchange Rates (Currency per U.S. Dollar)	1980	1985	1986	1987	1987-IV
Taiwan—New Taiwan dollar	36.00	39.85	37.33	31.48	29.68
South Korea—Won	607.43	870.02	881.45	823.62	803.43
Hong Kong—Hong Kong dollar	4.98	7.79	7.80	7.80	7.79
Singapore—Singapore dollar	2.14	2.20	2.18	2.11	2.05

Export Unit Values in U.S. Dollar Terms (1980 = 100)*	1980	1985	1986	1987-III
Taiwan	100	94.9	99.3	118.1
South Korea	100	95.5	96.9	107.1
Hong Kong	100	88.3	90.2	93.0†
United States (Finished goods producer prices)	100	118.9	117.3	120.4

*Export unit values rather than wholesale prices are used for price competitiveness comparisons for export-oriented newly industrializing countries for two reasons: 1) a wholesale price index is not available for Hong Kong, and 2) export incentives have put a wedge between export prices and wholesale prices for some of these economies. Singapore does not report an export unit value index.

†July-August average.

directly. In a survey of manufacturers taken in 1985, almost every U.S. respondent considered the ability to offer consistent quality to be of the highest importance competitively.¹² (In contrast, Japanese respondents felt the ability to offer low prices or undertake rapid design changes was a more important factor.) Given the high cost of defects, these recent quality efforts should aid both U.S. product desirability as well as relative U.S. price performance.

Underlying causes of the U.S. competitiveness improvement—analysis and outlook

Several factors underlie the substantial increase in U.S. competitiveness during the past several years. Most obviously, this improvement reflects changes in exchange market conditions resulting in the large depreciation of the U.S. dollar since 1985. Restrained wage growth has also been very important for improving the relative U.S. price position, but at the cost of slower growth in real earnings for manufacturing employees. More positive for U.S. competitiveness have been other major factors affecting U.S. price and quality. These factors include investment levels, technology efforts (spurred by research and development expenditures), industrial restructuring, and, to a more limited extent, work reorganization. It is these factors that shape how modern and efficient the production process is, as well as how technologically advanced and defect-free manufactured output becomes. And accordingly, it is these factors that determine the level of output per unit of input and the quality of the output produced. Perhaps most importantly, these factors affect the overall level of wage increase manufacturing employees can expect, a major goal of the competitiveness drive.

Significant changes in exchange market conditions, investment levels, technology efforts, industrial structure, and work organization have occurred in recent years. These changes precede improvements in price and quality competitiveness, which in turn occur well before actual purchase decisions are made and market shares determined. It is important to examine recent changes in these underlying factors to understand current competitiveness gains and to anticipate near-term competitiveness changes. Moreover, since some changes in these factors can be forecast in advance, it is helpful to analyze these factors to gauge what medium-term competitiveness changes may occur. Changes in factors other than the exchange rate merit more detailed attention. These changes are less obvious but, in a period when increasing emphasis is being placed on exchange rate stability, may become even more impor-

tant in determining future competitiveness positions.

Changes in exchange market conditions

The recent depreciation of the dollar brought it back to its beginning-1980 level after an extraordinarily volatile seven-year period. This depreciation has already had some impact on U.S. demand for foreign products as well as foreign demand for U.S. goods. The overall impact of depreciation on U.S. market share, however, will not be fully realized until 1989 because of long-term contracts, purchasing arrangements, and inventories.

A broader consequence of the seven-year exchange rate period as a whole has been an increased desire by all countries for a relatively more stable exchange rate environment. Proposed policy coordination across countries may help achieve this goal. A relatively more stable exchange rate environment would mean that exchange rate movements would play a significantly smaller role in determining competitiveness position in the future.

Changes in investment

Investment levels are a critical factor underlying the productivity and quality performance of U.S. manufacturing. These levels determine how fast new technologies, which improve product quality and productive capability, are brought into the manufacturing process. An increase in the amount of investment also leads to an increase in labor productivity as each laborer is provided with additional or more efficient capital equipment.

Perhaps the clearest example of the beneficial impact investment has on competitiveness comes from one section of the U.S. steel industry. The "mini-mills," which have invested in technologically advanced electrical furnaces, are both less capital intensive and more productive than standard integrated steel mills. Their widespread introduction into the steel industry in the 1970s and 1980s vastly improved the productivity record of U.S. steel manufacturers. In 1960 it took 2.9 man-hours of labor to produce a ton of steel; in 1985 it took only 0.9 manhours to produce a ton of steel, with a reduced capital equipment requirement as well. In 1960 mini-mills accounted for less than 3 percent of steel production in the United States; in 1985 they accounted for roughly 20 percent.¹³ Mini-mills, moreover, have also been credited with improving steel's quality record in recent years; their continuous casting production method yields a more uniform, better quality product.

U.S. gross manufacturing investment levels in general provided strong support to U.S. relative competitiveness

¹²Kasra Ferdows and others, "Manufacturers in U.S., Europe, Japan disagree over what makes a winner," *International Management*, September 1985, pp. 82-87.

¹³Ronald Barnett and Robert Crandall, *Up From the Ashes*. Brookings Institute, 1988, pp. 57-59.

throughout the 1980s. The level of U.S. real manufacturing investment to real manufacturing sales increased substantially over the last seven years from its average level during the 1970s (Table 4). In the early 1980s this increase was due to a larger downturn in sales than in investment. From 1984 on, however, the robust performance of the U.S. investment/sales ratio reflected brisk investment in the presence of a sharp upturn in sales. The U.S. performance compares favorably with developments in Japan and Germany. The average annual U.S. investment/sales ratio in the 1980s was only 0.3 percentage points behind the Japanese ratio, after having trailed it on average by 0.7 percentage points in the preceding decade. The U.S. ratio was sharply above the German ratio in the 1980s, substantially widening its 1970s lead.

Even more impressive than the increase in the U.S. investment/sales ratio was the increase in the U.S. real manufacturing investment/manufacturing employee ratio. This latter ratio, which measures the amount of new equipment available for use by production workers,¹⁴ has a more direct bearing on total labor productivity. The U.S. ratio in the last six years has been significantly above both Japanese and German levels. Although the U.S. ratio reflects to some extent the greater need to replace an older capital stock than is the case in Japan and Germany, replacing equipment still leads to an increasing spread of new technology.

The U.S. investment/sales and investment/employee ratios showed particularly strong improvement starting in 1984. This development coincides with the particularly sharp productivity pick-up of the middle 1980s. U.S. investment levels were especially high in 1985 in order to avoid some negative tax reform effects for investment in 1986. However, the U.S. investment/sales ratios in 1986 and 1987 still remained well above the average level of the 1970s. The 1986 and 1987 investment/employee ratios remained significantly above the ratios for both the 1970s and early 1980s.

As for the future, it appears that investment will continue to have a favorable impact on U.S. productivity and competitiveness, at least in the near term. The gestational lag between investment and increased output, lasting up to several years, suggests that the relatively strong investment performance of the past few years will have a beneficial effect on competitiveness at least through 1989. Investment prospects in the immediate future imply that this beneficial effect will continue into the 1990s. Although the stock market crash in October increased uncertainty about the economic and investment outlook, the current backlog of invest-

ment orders and survey responses concerning investment plans since then suggest ongoing investment strength.¹⁵ High expenditure levels on research and development (discussed in the next section) also imply concomitant high investment expenditure levels. Growing capacity constraints in manufacturing should act as a further investment spur. With a manufacturing capacity utilization rate of 82 percent at the end of 1987, capacity constraints are currently at their tightest level since 1979.¹⁶

Capital cost considerations also seem to indicate that investment will remain relatively buoyant, at least in the short run. Real long-term interest rates remain significantly below their 1982-84 peaks. These rates are also currently below the levels of the strong investment years of 1985-86. Over a longer time period, this financial situation could change, however. Investment expendi-

¹⁵"Plant and Equipment Expenditures," *Survey of Current Business*, vol. 67, no. 12 (December 1987), pp. 16-19. Strong growth in investment expenditure by the total U.S. business sector in 1988-1 also suggests continued manufacturing investment strength.

¹⁶*Federal Reserve Bulletin*, monthly issues.

Table 4

Manufacturing Investment Ratios

	United States	Japan	Germany
Real manufacturing investment/real manufacturing sales			
1973-79 average	5.4	6.1	5.0*
1980-86 average	6.4	6.7	4.9
1980-83 average	6.2	6.2	4.8
1984-86 average	6.6	7.2	4.9
1986	6.3	7.4	5.1
1987	6.2		
Real manufacturing investment/manufacturing employee†			
1976-79 average	4.8	3.3	3.2
1980-86 average	6.1	4.9	3.8
1980-83 average	5.7	4.5	3.6
1984-86 average	6.7	5.6	4.1
1986	6.5	5.5	4.3
1987	6.5		

*1974-79 average.

†The calculation of this ratio is described in text footnote 14.

Sources: For German investment through 1985, Organization for Economic Cooperation and Development, *National Income Accounts, 1973-1985*, vol. 2, 1987. German investment in 1986 is based on growth in investment in the entire business sector. Deutsche Bundesbank, *Supplement to Monthly Report*, series 4, March 1988. For Japanese investment, Japan Economic Research Center, *Five Year Economic Forecast*, various years.

¹⁴This ratio is calculated by dividing the level of gross investment in constant 1980 prices converted into dollars at 1980 exchange rates by the number of manufacturing employees.

tures growing to keep pace with growing sales levels could put increasing pressure on borrowing costs. This increasing pressure might be eased by a falling public sector demand for borrowed funds. But if the U.S. government deficit and its resultant borrowing requirements remain high, capital cost considerations could have a restraining influence on investment in the medium term. On the other hand, manufacturing investment has generally been more responsive to changes in demand for manufactured products than to changes in borrowing costs. Consequently, improved competitiveness itself offers support for a strong investment outlook and further competitiveness gains.

Changes in technology and research and development efforts

Technology growth, supported by research and development expenditures, determines how fast new production methods and product improvements are devised, adapted, and implemented in production. Consequently, technology growth has a direct impact on productivity and quality performance. In fact, improved technology has been found to be extremely important for output growth. Analysts have estimated that technological advances, broadly defined, accounted for about two-thirds of the growth in U.S. output since 1900.¹⁷ Technology growth has also been extremely important for quality improvements. Major quality control techniques, such as statistical process control and changes in design to eliminate quality problems before production actually begins, are the direct product of technological innovation.

The United States registered a very weak research and development performance relative to its major foreign competitors during the 1970s. The ratio of U.S. industrial research and development/manufacturing sales remained stagnant over that decade while foreign ratios grew.¹⁸ As a result the United States lost some of its technological lead. Quality problems reflecting inferior U.S. technology arose in a number of U.S. industries, such as paper and textile machinery (see Appendix). By the end of the decade the United States was in a position where it could no longer be assured of sales based purely on a superior technological reputation.

As with U.S. manufacturing investment, however, there was a sharp improvement in U.S. technology efforts as

¹⁷Edward Shapiro, *Macroeconomic Analysis* (New York: Harcourt Brace Jovanovich, 1974), p. 401. As noted in the previous section, most of the new technology required capital investment, making investment expenditures very important.

¹⁸Research and development expenditures are often reported as ratios to GNP. Given the relatively large size of the U.S. service and agricultural sectors, however, reporting research and development/ GNP ratios gives a downwardly biased impression of the U.S. research and development effort in manufacturing.

measured by research and development expenditure in the 1980s. After the stagnation of the 1970s, the ratio of U.S. industrial research and development/manufacturing sales grew substantially throughout the 1980s (Table 5). By 1985 the U.S. ratio, at 2.4 percent, reached a level significantly above the German ratio and slightly above the Japanese ratio. In 1979, by contrast, the German ratio was higher than the U.S. ratio and the Japanese ratio about equaled that of the United States.

Some analysts have suggested, however, that increasing the *level* of research and development expenditure will not solve the U.S. technology problem. They argue that the *composition* of research and development expenditure needs to be changed, with greater resources devoted to the application of new technologies than to their discovery. In short, they contend that too much attention has been given to basic research at the expense of development, implying that many of the gains to efficient innovation have been lost.¹⁹ The video cassette recorder is the most often cited example of products originating from U.S. research but developed for market by firms in other countries, particularly Japan. Patent evidence is also advanced to support the contention that the United States is weak on developing the products it invents. The share of U.S.

¹⁹See for instance the statement of Myron Tribus, Director, Center for Advanced Engineering Study, Massachusetts Institute of Technology, Hearings before the Subcommittee on Economic Stabilization of the House Committee on Banking, Finance and Urban Affairs, 98th Cong., 2d sess. (Washington, D.C.: GPO, March 1984), pp. 129-52; or James R. Kirk, "Easing the Way from Lab to Market Place," *Tough Challenges for R&D Management*, the Conference Board, 1987.

Table 5

Research and Development Trends

	Industrial Research and Development Expenditures as a Percent of Manufacturing Sales		
	United States	Japan	Germany
1979	1.51	1.49	1.67
1981	1.78	1.67	1.80
1982	2.05	1.88	1.92
1983	2.12	2.01	1.87
1984	2.17	2.02	1.98
1985	2.39	2.24	1.99
1986	2.62		
Change (percentage points):			
1970-79	-0.15	0.30	0.22
1980-85	0.88	0.75	0.32
U.S. Patents Granted to Inventors by Nationality			
	1970	1979	1985
United States	47077	30079	39554
Japan	2625	5251	12746
Germany	4435	4527	6665

Source: National Science Foundation for research and development expenditure levels and patent data.

patents granted to U.S. nationals has fallen significantly since 1970 while the share granted to Japanese nationals in particular has risen sharply.²⁰

Encouraging efforts have been made in the last few years to address this problem as well. Antitrust laws have been relaxed to encourage industry consortiums, such as the computer industry's Microelectronics and Computer Technology Corporation, that are geared to sharing research and encouraging the development of products based on this research. Technological parks have also sprung up to promote the interaction of industry, government, and university personnel so that basic research might give rise to more commercial innovation. There are now around 300 of these parks, up from only 100 in 1980.²¹

It is of note that at the same time the United States is moving more in the direction of applied research, Japan is moving somewhat in the reverse direction as a result of the success of its strong development effort in the 1970s. With much "catch-up" technological development already over, the Japanese government has now issued new research and development guidelines that put greater emphasis on basic research. According to the *Japan Economic Almanac*, the guidelines are based on the premise that "until now, Japan has concentrated on adapting technologies imported from the U.S. and Europe to promote its own scientific and technological innovations. But Japan must now shift from a beneficiary to a benefactor."²²

This evidence of role reversal between basic and applied research efforts, however, must not be taken to mean that the United States and Japan are currently following the same overall technology strategy. A review of current technological investment in the United States and Japan suggests that the research and development priorities of the two countries continue to diverge. The United States has been concentrating investment efforts on computer software technology designed to speed the creation of new products, while Japan has been concentrating on computer hardware technology designed to speed the creation of new production techniques. The United States has invested much more heavily in computer-aided design (CAD) and computer-aided manufacturing (CAM) systems than has Japan. These systems

greatly reduce the time it takes to develop new products. Japan, in contrast, has spent significantly more on the development of robots and flexible manufacturing systems (automated assembly systems that rapidly adjust to produce different products).²³ These systems are geared to reduce the costs of production.²⁴

These differing investment patterns appear to indicate that the United States continues to put more emphasis on creating new products while Japan puts more emphasis on reducing the cost of producing and adapting existing products to meet specific consumer needs. Still, rapidly growing U.S. expenditures on computer-aided design and computer-aided manufacturing imply an increased U.S. effort to translate research into commercial products.

Aside from promoting the development of new products, rapid growth in the use of CAD/CAM systems in the United States is also very encouraging for U.S. competitiveness because of the tremendous promise it holds for directly improving manufacturing's productivity and quality performance. According to the U.S. Department of Commerce, "Documented cases of productivity improvements from the implementation of CAD/CAM systems have cited output per manhour worked jumping anywhere from 5:1 to 20:1. . . . [Moreover] improvement in product quality and performance can be achieved through better design, greater machining accuracy, and reduction in human errors."²⁵ As noted earlier, CAD/CAM systems are ideally suited to quality control attempts to "design out" problems before products are actually manufactured. Consequently, their relatively fast growth and widespread application in the United States suggest a potential competitiveness gain that will last into the 1990s. A study by the Society of Manufacturing Engineers projected that 25 percent of all U.S. companies will employ CAD/CAM systems for product and tool design by 1990, as against 20 percent of Japanese companies and only 10 percent of the British companies.²⁶

More generally, the renewed U.S. research and development efforts suggest a continuing boost to

²⁰Patent comparisons have to be made with caution. The annual recorded number of patents obtained by different countries' nationals in any given country will be affected by the correlation between the date of patent application and the date other countries begin to make significant export sales to that country. Patent data also mix patents for adaptations in existing products with patents for new products.

²¹Edward Ungar, "Finding and Tapping the Sources of Innovation," in *Tough Challenges for R&D Management*.

²²*Japan Economic Almanac 1987*, Japan Economic Journal, p. 241.

²³In 1985 the ratio of apparent U.S. consumption of CAD/CAM systems to U.S. consumption of robotics was 11 to 2 while in Japan the ratio was 10 to 11. The Japanese definition of "robotics" includes certain categories of mechanical manipulators that the U.S. definition leaves out. Nevertheless, the discrepancy between CAD/CAM and robotics consumption in the United States is so great that robotics consumption would have to be inflated by over 500 percent to bring the U.S. ratio up to the Japanese level.

²⁴Ferdows and coauthors discuss these contrasting spending patterns in "Manufacturers in U.S., Europe, Japan disagree," pp. 82-87.

²⁵U.S. Department of Commerce, International Trade Administration, *A Competitive Assessment of the U.S. Computer-Aided Design and Manufacturing Systems Industry*, February 1987, p. 4.

²⁶U.S. Department of Commerce, *A Competitive Assessment*, p. 45.

competitiveness over the next several years. Since the gestational lag between expenditure on research and development and the initial returns on that expenditure is about two years, the strong U.S. showing in research and development through 1986 can be expected to aid competitiveness for some time. Moreover, research and development expenditure is likely to remain high, although an easing of competitiveness pressures may limit its growth. A survey of research and development managers taken in early 1988 indicated 1988 research and development/sales ratios were expected to remain at 1987 levels, which in turn matched 1986 levels.²⁷ Equally important, the survey showed that top manufacturing management's interest in research and development has remained strong.

On a financing level, survey results indicate that strong profit growth generally supports high research and development expenditure levels.²⁸ U.S. manufacturing profit rates are widely expected to continue rising into 1989. Consequently, financial conditions also suggest that research and development efforts may continue to boost U.S. competitiveness into the 1990s.

Changes in industrial structure

Along with undertaking stronger efforts in investment and research and development in the 1980s, U.S. manufacturers reacted to competitiveness problems by sharply escalating the scale of industrial restructuring. In its broadest definition, industrial restructuring includes both real consolidation associated with layoffs and other cost reduction efforts and financial diversification associated with mergers and acquisitions. Increased use was made of both practices during the last seven years.

Job layoffs and plant closings generally have a positive effect on productivity and, therefore, on competitiveness measured in market share terms, albeit at a high cost to U.S. manufacturing employees. The positive impact of job layoffs and plant closings on productivity is fairly direct. Layoffs and closings cut the number of excess workers and the level of underutilized capital, thereby improving the output/employee and output/capital stock ratios. Cuts generally affect the less experienced employees and the less efficient plants, further boosting productivity. Of course, some of the gains to productivity are offset by the loss of specific task-related

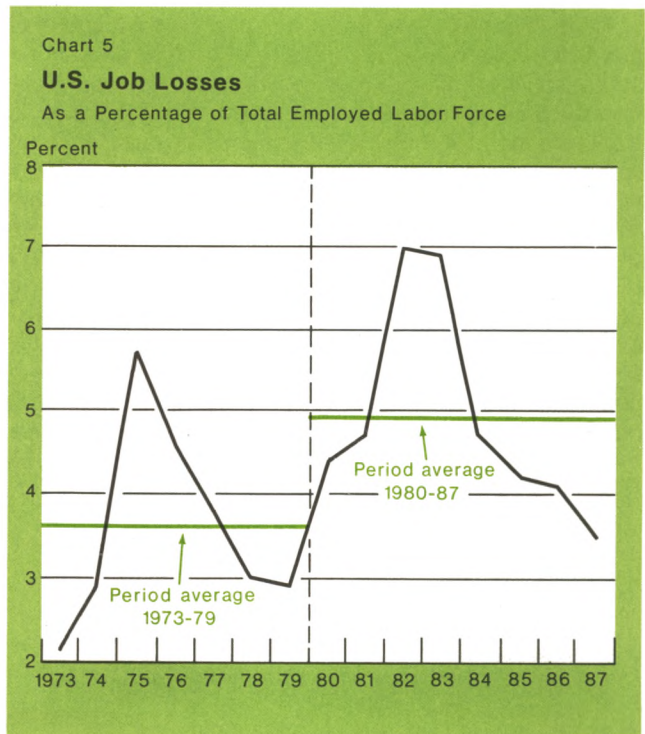
skills when workers are forced into temporary or permanent changes in jobs. Nevertheless, the net impact of workforce and plant trimmings on productivity is, at least initially, positive.

Job losses and plant closings in the 1980s increased sharply from their levels in the 1970s. Job losers in all industries averaged about 5 percent of the employed labor force, or 4.6 million people, during the 1980-87 period, in contrast to only 3.5 percent of the labor force, or 2.9 million people, during the 1973-79 period (Chart 4). While a portion of the high 1980s average represents cyclical adjustment to the severe recession at the start of the decade, at least a portion seems to represent a more structural change toward workforce trimming, itself in part due to the substitution of machines for jobs. In fact, even after the 1980s recovery was firmly established, layoff rates remained relatively high, with the average 1984-87 layoff rate substantially greater than nonrecessionary averages for the 1970s. About one-half of job losers were from manufacturing industries.

As for plant closings, the dollar value of retirements of manufacturers' buildings more than doubled from \$18.3 million in 1979 to \$41.7 billion in 1985. Some of these "retirements" reflect ownership changes rather than actual plant closings. Dollar values have also risen

²⁷"Industrial Research Institutes' Annual Research and Development Trends Study," *Research-Technology Management*, January-February 1988, pp. 30-33. Survey results from Battelle show similar research and development expenditure plans. Battelle's survey indicates that private research and development expenditure is expected to grow 4 to 5 percent in 1988. This is about the rate by which manufacturing sales are expected to grow. The Battelle survey is cited in *Forbes*, February 8, 1988, p. 29.

²⁸"Accounting for Research and Development Expenditure," *Research-Technology Management*, January-February 1988, p. 40.



because of inflation. Nevertheless, the numbers are evidence of significant plant restructuring activity in the 1980s.

The relatively high rate of layoff and plant closing activity during the last seven years will, however, likely be self-limiting in the near future. The extent of layoffs and closings since 1980 suggests that a major proportion of inefficient production units have already been removed, reducing the productivity gains from further layoff and closing activity. Strong sales growth, moreover, has left capacity utilization rates high in a number of manufacturing industries. Increased employment and investment rather than layoffs and closings appear likely in many areas.

Merger and acquisition activity, the other major form of industrial restructuring, has also had some impact on recent U.S. price competitiveness, although the magnitude of its effect has been debated. In principle, mergers and acquisitions can improve productivity and profitability by encouraging units in the newly formed organizations to cooperate and to share knowledge and managerial skills. Despite the positive effects of integration, however, mergers and acquisitions change management structures and work relations in ways that may be harmful, at least initially, to workplace industrial relations. Evidence to date suggests that merger and acquisition activity has improved productivity performance in some areas but not uniformly throughout manufacturing.²⁹

At an industry level some positive association has been found between the intensity of merger and acquisition activity and industrial productivity growth. Specifically, the high merger activity levels in mining, railroad transportation, and electrical equipment manufacturing were associated with rapid productivity growth in these same industries over the 1980-85 period.³⁰ On the other hand, a recent study of the merger and acquisition records of the 33 largest diversified U.S. companies over the period 1950-86 shows that, on average, the acquiring companies had eventually divested themselves of greater than 50 percent of their acquisitions in new industries and greater than 60 percent of their acquisitions in new fields because of disappointing profit outturns.³¹ Given these mixed results, it is unclear what effect future merger and acquisition activity will have on U.S. competitiveness.

²⁹See for example, the analysis offered by Michael Porter, "From Competitive Advantage to Corporate Strategy," *Harvard Business Review*, May-June 1987, pp. 43-59.

³⁰John Paulus and Robert Gay, "U.S. Mergers are Helping Productivity," *Challenge*, May-June, 1987, pp. 54-57.

³¹Porter, "From Competitive Advantage," pp. 43-59.

Changes in work organization

Major changes in work organization have taken place in the United States over the last seven years. Many of these changes have been inspired by the perceived success of Japanese work organization. The Japanese model features lifetime employment, widespread profit sharing, teamwork, and the creation of quality and management circles in which employees share ideas for improving both the product and the production process. Among recent U.S. changes are increased use of quality circles, profit sharing as a means of remuneration, increased adoption of work teams with joint responsibility for production, reduction of work rules assigning individual tasks, and reduction in the number of job classifications and titles at the workplace.

Some of these changes have been fairly broadly adopted. For example, employee involvement programs are fast becoming an important component of U.S. human resource management strategy. A 1982 study by the New York Stock Exchange showed that 52 percent of large firms (with greater than 10,000 workers) had a formal quality circle program. Many of these programs have been implemented in smaller work establishments as well.³²

Another Japanese-inspired concept recently adopted fairly widely in the U.S. workplace is the use of profit-sharing arrangements as a form of employee remuneration. In 1986 one-third of all major collective bargaining agreements included a lump sum or profit-sharing clause, up from only 1 percent in the late 1970s. Although many changes arose from concessionary bargaining during the recession of the early 1980s, the use of lump sum and profit-sharing arrangements and the reduction of work rules have been occurring with much greater frequency since 1984 (Chart 6) than during the recessionary years.³³

It is still relatively early to judge the impact of these work organization changes. Current evidence suggests that, like mergers and acquisitions, the new practices have had substantial payoffs in some but not all instances. At the General Motors, Toyota, and United Auto Workers joint venture New United Motors Manufacturing Incorporated (NUMMI) Plant, where many new work organization methods have been implemented, reported productivity is an astounding 50 percent higher

³²For the New York Stock Exchange Survey of large establishments, see William C. Freund and Eugene Epstein, *People and Productivity*, Dow-Jones-Irwin, 1984. For a survey of somewhat smaller establishments (greater than 1,000 workers), see Sirota and Alper Associates, *The National Survey of Employee Attitudes*, 1985.

³³For a discussion of the path of employee concessions in the 1980s, see Linda Bell and Elizabeth Hall, "Concessionary Bargaining in the 1980s," unpublished paper, 1987.

than before changes were adopted.³⁴ However, within the U.S. automotive industry, with the exception of U.S.-Japanese joint ventures, the adoption of Japanese-style production has apparently been less successful to date.³⁵ Similar results are found in a study of the productivity effects of employee stock ownership plans.³⁶ Some success has been reported in achieving quality improvements from changes in work structure. Placing workers on design teams with engineers has proved to be a major factor in improving the quality performance of electronic components producers.

Overall, the impact of work organization changes has

³⁴The NUMMI plant guarantees job security to workers. It also places them in work teams and trains them for multiple task assignments. The job classification system has been reduced from nearly two hundred original occupational titles to just three. The major change in physical plant has been the introduction of an in-plant stamping section. This change was adopted in order to use the Japanese Just-in-Time production system, in which output goals are determined by input needs at subsequent production stations.

³⁵Haruo Shimado and John Paul MacDuffie, "Industrial Relations and 'Human Ware': Japanese Investments in Automobile Manufacturing in the United States," National Bureau of Economic Research Conference Paper, December 1986.

³⁶Steven Bloom, "Employee Stock Ownership and Firm Performance," Ph.D. dissertation, Harvard University, 1985.

been mixed. What does appear encouraging for U.S. competitiveness in the future is the fairly strong willingness of U.S. labor and employers to make adjustments to work organization in an attempt to achieve productivity and quality improvements. There has been a strong growth trend in profit-sharing and work-rule reduction plans in the 1980s. Both this growth trend and the receptiveness to new work arrangements suggest that support for productivity growth may continue to come from the work organization area.

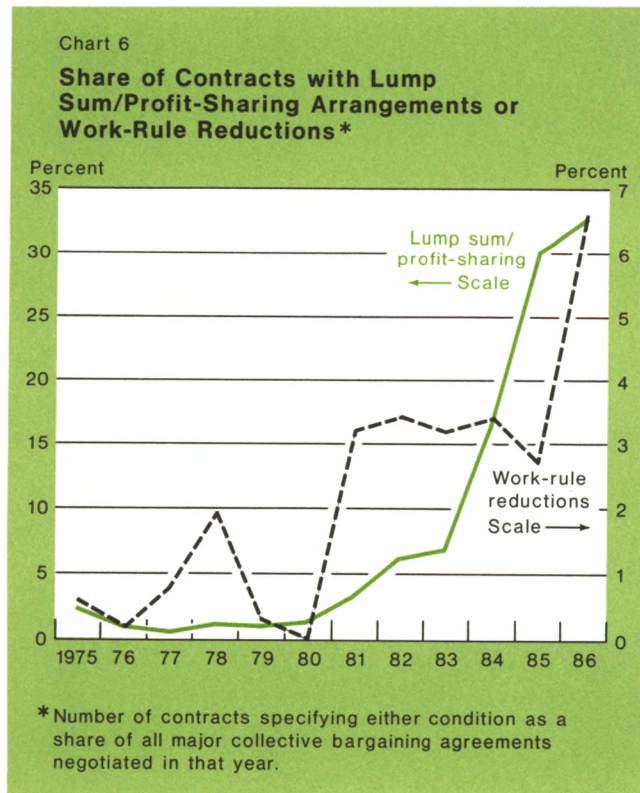
Conclusions

U.S. manufacturing has clearly become more competitive in recent years. This achievement was the result of sharp dollar depreciation, wage restraint, and strong improvements in U.S. productivity and quality performances. At a more fundamental level, these improvements reflect increased investment levels, technology promoted by research and development efforts, industrial restructuring, and work reorganization.

In the near future, the competitive position of the U.S. manufacturing sector will most likely improve further. The full trade benefits of recent dollar depreciation will not be felt until the end of 1989. Moreover, changes in underlying productivity and quality determinants that have already occurred suggest further strong productivity growth and ongoing quality improvement. Specifically, typical gestational lags between expenditure and return imply that the vigorous investment and research and development efforts undertaken in manufacturing in recent years will promote productivity and quality advances at least through the end of the decade. Recent work organization changes and merger activity should also promote some productivity and quality improvement, although benefits will be much more sporadic across industries and firms.

Beyond the next year or so, ongoing trends in the key determinants suggest continued competitiveness improvement. Planned expenditures for investment and research and development remain strong, with those for 1988 matching their high 1987 levels. The search for new work organization and management techniques is also steadily progressing. Over time these positive trends should lead to greater U.S. competitiveness, with a concomitant decline in the U.S. foreign trade deficit and improved job opportunities and compensation for manufacturing employees.

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Appendix: Industry-specific Quality Comparisons

International quality comparisons are available for 11 broad industry groupings. These comparisons vary in depth of coverage both in regard to change over time and detail of analysis. Summaries of the comparisons are presented here. On the basis of these comparisons, we have classified U.S. industries as having a "quality problem" or "no quality problem." Two of the industries are classified as having "quality improvement." The quality comparisons for these two industries suggest that U.S. products had been found inferior but had improved over time. Conclusions drawn from the 11 quality comparisons are presented in the text.

Automobiles

(1986 shipments of \$111 billion)—quality problem

Consumer Reports ratings for selected U.S. and Japanese automobiles for 1970, 1980, and 1985 suggest that U.S. cars had on average more repair problems than the Japanese models. (Model lines selected for comparison were model lines that were rated in all three years.)

Business Week also reported that new 1987 U.S. cars

standards within the U.S. paper industry were substantially inferior to those in European paper industries. The report found that the U.S. industry suffered from insufficient investment in research and development and a lack of interaction between product suppliers and consumers. The rapid development of new products in Europe eroded the market share for U.S. products. European product development was supported by a cooperative relationship between producers, distributors, publishers, and others involved in the use of paper products. This European network fostered better market feedback, which in turn encouraged product innovation and improved product performance. An industry executive observed, "The pendulum has swung and many U.S. pulp and paper companies are now paying for a lack of foresight."[†]

Further, the industry's quality standards for newsprint have suffered in comparison with those of Japanese newsprint producers. The *Japan Economic Almanac 1987* reported that Japanese newspaper companies found Japanese newsprint quality substantially superior to U.S. quality.[‡]

Percentage of Categories in Which Autos Had a Better or Worse than Average Repair Record

	1970		1980		1985	
	Better than Average	Worse than Average	Better than Average	Worse than Average	Better than Average	Worse than Average
Chevrolet Camaro	35	12	0	29	0	82
Ford Thunderbird	7	47	20	47	27	7
Pontiac Grand Prix	13	27	0	33	7	27
Toyota Corolla	35	18	94	0	65	0
Datsun 510/Maxima	53	18	76	6	24	18

Note: Categories are air conditioning, exterior body, body hardware, body integrity, brakes, clutch, drive line, electrical chassis, engine cooling, engine mechanics, exhaust, fuel system, ignition system, steering suspension, transmission. In some instances, models could not be rated for all categories.

Source: Derived from *Consumer Reports*, new car issue, various years.

had more after-sale problems than Japanese and German imports, although fewer than Swedish imports. For every 100 new U.S. cars sold, 175 problems were reported up to 90 days after purchase; this figure contrasts with 129 problems per 100 Japanese cars, 152 problems per 100 German cars, and 200 problems per 100 Swedish cars.*

Paper and allied products

(1986 shipments of \$103 billion)—quality problem

A Dow Chemical Company report found that quality

Steel (1986 shipments of \$46 billion)—quality improvement

Ford Motor Company reported that during 1979-81 its rejection rate for steel supplied by U.S. companies was about 8 to 9 percent, in contrast to a 3 percent rejection rate for European steel suppliers and a 1.5 percent rejection rate for Japanese steel suppliers. By 1985, however, the rejection rate for U.S. steel suppliers had fallen to less than 2 percent, as against 3 percent for European suppliers and 2.5 percent for Japanese sup-

**Business Week*, June 8, 1987.

[†]*Pulp and Paper*, April 1987, pp. 54-62.

[‡]*Japan Economic Almanac*, 1987, p. 169.

Appendix: Industry-specific Quality Comparisons (continued)

pliers. Ford Motor Company also reported a "dramatic" improvement in delivery time from U.S. steel suppliers over this time period.§

Electronic parts (1986 shipments of \$40 billion)—quality improvement

Xerox Corporation reported that in 1984 U.S. electronic parts supplied to Xerox were roughly five times as likely to fail as parts supplied to Fuji Xerox Company Ltd. of Tokyo (Xerox's joint venture with Fuji Photo Film Company Ltd.). By 1986, however, U.S. parts supplied to Xerox had attained quality parity with Japanese parts supplied to Fuji Xerox.||

Pharmaceuticals

(1986 shipments of \$33 billion)—no quality problem

The International Trade Administration underscored "the competitive strength of U.S. pharmaceutical companies" and attributed this strength to "the quality and reputation of the pharmaceuticals produced by those companies."¶

Construction equipment

(1986 shipments of \$14 billion)—no quality problem

The International Trade Administration concluded that "technical superiority, high quality products, and superior service and dealership networks" characterized the U.S. construction equipment industry in comparison to foreign competitors.**

Consumer electronics

(1986 shipments of \$8 billion)—no quality problem

Consumer Reports ratings for U.S. and Japanese microwave ovens, stereo speakers, and 19-inch televisions in 1975, 1981-82, and 1985-86 suggest that U.S. and Japanese quality records were about even.

Machine tools

(1986 shipments of \$5 billion)—no quality problem

An International Trade Commission survey of U.S. purchasers of machine tools suggested that standardized U.S.-made machine tools suffered in quality comparison with standardized foreign-made machine tools, but it

rated U.S. quality higher for specialized machine tools. "Purchasers responded [in the survey] that overall, in their opinion, foreign-made machine tools are better designed than U.S.-made machine tools, have higher productivity, and require less maintenance. U.S.-made machine tools were rated as slightly more durable than foreign-made products. U.S. machine tool builders have generally concentrated on production of specialized types of machine tools for the machinery and fabricated-metal products industries, as well as the transportation industry. As a result, purchasers in these industries have indicated that U.S.-made machine tools are superior to foreign-made machine tools."††

Electric power generating equipment

(1986 shipments of \$4 billion)—no quality problem

A comparison of the performance of U.S.-made and

††U.S. International Trade Commission, "Competitive Assessment of the U.S. Metalworking Machine Tool Industry," September 1983, p. 105.

Consumer Electronics

Percentage of Product Characteristics in Which Products Had an Average or Better Rating

(Number of Products Rated in Each Category in Parentheses)

Product	1975	1981-82	1985-86
Microwave ovens			
Number of characteristics rated per product	—	5	2
U.S. product ratings	—	60 (1)	79 (5)
Japanese product ratings	—	47 (3)	100 (7)
Stereo speakers			
Number of characteristics rated per product	2	3	2
U.S. product ratings	42 (6)	62 (9)	50 (8)
Japanese product ratings	100 (2)	25 (4)	50 (4)
Televisions			
Number of characteristics rated per product	12	9	13
U.S. product ratings	81 (4)	75 (4)	88 (2)
Japanese product ratings	75 (2)	68 (7)	84 (8)

Note: Both the products and the characteristics upon which the evaluations are based varied across the sample periods. No correction for these factors is made in the reported percentages.

Source: Derived from *Consumer Reports Buying Guide* issues for 1975, 1982, and 1987.

§Paul R. O'Hara, "Assuring Steel's Competitiveness for the Automotive Industry," in *Steel Comments*, American Iron and Steel Institute, February 28, 1986.

||*Electronic Business*, January 15, 1987.

¶U.S. Department of Commerce, International Trade Administration, "A Competitive Assessment of the U.S. Pharmaceutical Industry," December 1984, p. 86.

**U.S. Department of Commerce, International Trade Administration, "A Competitive Assessment of the U.S. Construction Equipment Industry," February 1985, p. 73.

Appendix: Industry-specific Quality Comparisons (continued)

foreign-made electric power generating equipment used by the Tennessee Valley Authority shows that U.S.-made equipment is superior. U.S.-made equipment significantly outranked foreign-made equipment in terms of both the availability factor (the ratio of time equipment is able to produce electricity to the total time in a given period) and the capacity factor (the ratio of power actually generated by equipment to the power the equipment would generate if operating at full capacity for a given time period). The North American Electric Reliability Council reported similar results from statistical data collected from all U.S. electric utilities.‡‡

Textile machinery (1986 shipments of \$1 billion)—quality problem

The International Trade Administration found a quality problem with U.S.-made machines. "The primary factor affecting the competitiveness of U.S. textile machinery producers in both export markets and in the domestic market is the technology gap between foreign and U.S.-produced equipment. Although U.S. textile machinery producers have enhanced the level of advanced technology built into their yarn preparation and dyeing/finished equipment in recent years, they have not kept pace with foreign technological advances in the weaving and spinning sectors.... This assumes great importance since the weaving and spinning sectors of the industry have

generally accounted for the largest dollar portion of equipment sales....[U.S.] domestic producers are also unable to match the international marketing networks developed by foreign textile machinery manufacturers over the past 15 to 20 years."§§

General aviation aircraft (1986 shipments of \$1 billion)—no quality problem

The International Trade Administration found that U.S.-built aircraft rate high in relative quality. "The vast amount of production experience and the technological quality embodied in U.S. airplanes help to keep [U.S.] domestic manufacturers in the lead."// //

Note: A consumer appliance quality comparison has been excluded because international trade in consumer appliances is very small (given the large bulk of most appliances). David Garvin did provide evidence in a 1983 study ("Quality on the Line," *Harvard Business Review*, September-October 1983, pp. 65-75) that the quality of U.S. room air conditioners was inferior to the quality of Japanese room air conditioners. *Business Week*, however, found significant improvement in the quality of U.S. consumer appliances in the 1983 to 1986 period ("The Push for Quality," *Business Week*, June 8, 1987, p. 140).

§§U.S. Department of Commerce, International Trade Administration, "A Competitive Assessment of the U.S. Textile Machinery Industry," January 1987, pp. 31-32.

// //U.S. Department of Commerce, International Trade Administration, "A Competitive Assessment of the U.S. General Aviation Aircraft Industry," June 1986, p. xvii.

‡‡U.S. Department of Commerce, International Trade Association, "A Competitive Assessment of the U.S. Electric Power Generating Equipment Industry," October 1985, pp. 37-38.

Money Demand— Some Long-Run Properties

Many observers have cited the acceleration in the ratio of GNP to M1 (“velocity”) in the mid-1970s and its subsequent sharp decline in the 1980s as evidence of unprecedented instability in the demand for money. This interpretation has generally been supported by comparing the M1 statistics with the results obtained from econometric money demand equations estimated from the 1950s to the mid-1970s—a period when money demand was viewed as a stable function.¹ An alternative way of looking at the recent shifts in money demand is also possible, however. If it can be shown that the period from the 1950s to the mid-1970s was a unique episode, then these subsequent shifts in the demand for M1 may simply represent further instances of the money demand instability that occurred before the 1950s.

Identifying the more correct view has important implications for the use of M1 as a guide to policy in the future. The apparent stability of money demand from the 1950s to the early 1970s led many to view stability in this function as the norm. Consequently, apparent shifts in money demand in the mid-1970s and again in the 1980s were taken as exceptions to the norm, quite possibly linked to developments such as deregulation and innovation that were unique to these periods. Thus, a return to “more normal” stability would be a reasonable expectation for the future. On the other hand, however, if a longer-range analysis of money demand suggests that other such money demand shifts have

occurred, the view that money demand is normally “stable” and will return to this state after the current period of change has run its course would be open to some question. This article examines the latter possibility through a statistical analysis of money demand over a much longer period of time.

In his recent book, *The American Business Cycle*, Robert J. Gordon published statistics for the basic determinants of money demand (interest rates, GNP, and the price level) that span a considerably longer time period than is contained in most data bases.² Hence, these statistics enable us to put the unusually weak M1 growth in the mid-1970s, as well as what appears to have been unusually strong growth during much of the 1980s, into the perspective of a longer time period. By and large, our results suggest that the stability in the demand for M1 observed with data from the 1950s to the mid-1970s was a rather unique experience. Using statistics from 1915 through 1987, we were able to identify additional periods during which it appears that money balances deviated from econometric estimates by more than 10 percent. Unlike the demand for M1, the demand for M2 has not shown dramatic instability since the mid-1970s. But we were able to identify some periods in the years preceding the mid-1970s when the actual values of M2 diverged from econometric results by 10 percent or more.

In the first section of this article, we report some

¹For more detail, see David Laidler, *The Demand for Money: Theories, Evidence and Problems* (New York: Harper and Row, 1985); and John Judd and John Scadding, “The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature,” *Journal of Economic Literature*, September 1982, pp. 993-1023.

²Robert J. Gordon, ed., *The American Business Cycle* (Chicago, Illinois: University of Chicago Press, 1986), pp. 781-849. Gordon’s statistics cover the period from 1915 to 1983. The author of this article used conventional splicing techniques to add data for the 1984-87 period.

money demand estimates for the 1915-87 period as well as some estimates over selected subperiods. The results suggest that even though the parameters for money demand equations estimated over long time spans are consistent with economic theory, the size of these parameters has differed considerably within subperiods. This is particularly true for the demand for M1 in the 1950-73 period when both the income and interest rate elasticities were quite small. In the second section, we examine more closely the errors from the money demand equations. Here we find that the 1950-73 period was an unusually stable period for money demand. In addition, we find that in more recent years the errors from the M1 and M2 demand equations have not been as highly correlated as they were in earlier periods. Hence, M2 appears to have become a more useful guide for policy purposes during this period of instability in the demand for M1. In the final section, we use sequential, 10-year money demand estimates to identify some of the changes in the elasticities of the demand for money that have occurred over time. The analysis in this final section suggests that the recent changes in the responsiveness of the demand for M1 to income and interest rates, while quite dramatic, have not been totally unprecedented by long-run standards. It has not been uncommon for money demand coefficients to vary considerably over time.

Money demand estimates: 1915-87

This section presents some money demand estimates for M1 and M2 over the 1915-87 period and during some selected subperiods. The primary objective is to analyze the demand for M1 over the 1950-73 period both in the context of an extended time period and relative to the demand for M2.

Earlier studies of the demand for money over long time spans have used statistical time series that ended in the mid to late 1970s.³ Hence, much of the instability in the demand for narrow money during the 1980s has not been closely examined in this context. Moreover, these earlier studies have not assessed the stability of the demand for M1 in relation to that for M2 over the past 10 to 15 years—an important consideration given the apparently greater stability in the M2 function than in the M1 function during the 1980s. The Federal Reserve has not set targets for M1 in recent years but

continues to establish targets for the broader aggregates.

Much of the initial impetus for setting targets for M1 was based on the stable trend in its velocity in the 1950-70 period (Chart 1). One of the first problems encountered with monetary targeting was the unexpected acceleration in velocity beginning in the mid-1970s.⁴ Over time, the Federal Reserve took this more rapid velocity growth into account in setting the monetary targets because the acceleration appeared to stem from greater emphasis on cash management encouraged by rising nominal interest rates and increasing inflation. But as interest rates fell in the 1980s because of a decrease in actual and expected inflation, M1's velocity began an outright decline, not just a slowdown in growth rate terms. As a result, the authorities found it difficult for a second time in 10 years to set targets for M1 because of a pronounced unexpected shift in the trend of velocity.

While this decline in velocity during the 1980s was quite surprising to most analysts, it was not unprecedented in the context of a longer time span (as Chart 1 reveals). From 1915 to 1945, M1's velocity declined gradually and showed considerably more volatility relative to trend than was the case from 1950 to 1973. M2's velocity was also quite volatile in this earlier period.⁵ Indeed, the velocities of M1 and M2 followed a very similar pattern until the late 1950s. At that time, M2's velocity began to level off, remaining fairly constant in subsequent years, while M1's velocity started on a pronounced upward trend that lasted until the early 1980s.

The changes in the trend of M1's velocity in recent years have also been associated with periods of instability in the demand for M1. Money demand equations estimated over the 1950-73 period have not been able to track the growth of M1 accurately since that time. The demand for M1 was generally overestimated in the 1974-80 time span and underestimated in the 1981-87 period, suggesting that the demand for M1 has become more sensitive to interest rates since the mid-1970s. Hence, it appears that three periods could be studied

⁴For a further elaboration, see Stephen M. Goldfeld, "The Case of the Missing Money," *Brookings Papers on Economic Activity*, vol. 3 (1976), pp. 683-740.

⁵In terms of quarterly growth rates, the standard deviation of M1's velocity was 16.7 percentage points in the 1915-49 period. It fell to 4.8 percentage points in the 1950-73 period and increased to 6.3 percentage points in the most recent period. The standard deviation of M2's velocity fell from 16.8 percentage points to 5.6 and then to 5.1 percentage points. Both the GNP and money supply series showed considerably less volatility in the post-1949 period. This reduction in the volatility of the GNP statistics, however, is open to some question. For more background, see Christina D. Romer, "Is the Stabilization of the Postwar Economy a Figment of the Data?" *American Economic Review*, vol. 76, no. 3 (June 1986), pp. 315-34.

for money demand stability in a longer-run context: the period running from 1915 to about 1949, the period from 1950 to the mid-1970s, and finally the period since the mid-1970s, which has shown some evidence of increased sensitivity of money demand to increases and declines in interest rates. The demand for M2 during the same subperiods will be examined in order to make certain comparisons with the demand for M1. Table 1 contains money demand estimates for the total period and for these three subperiods, for both M1 and M2.

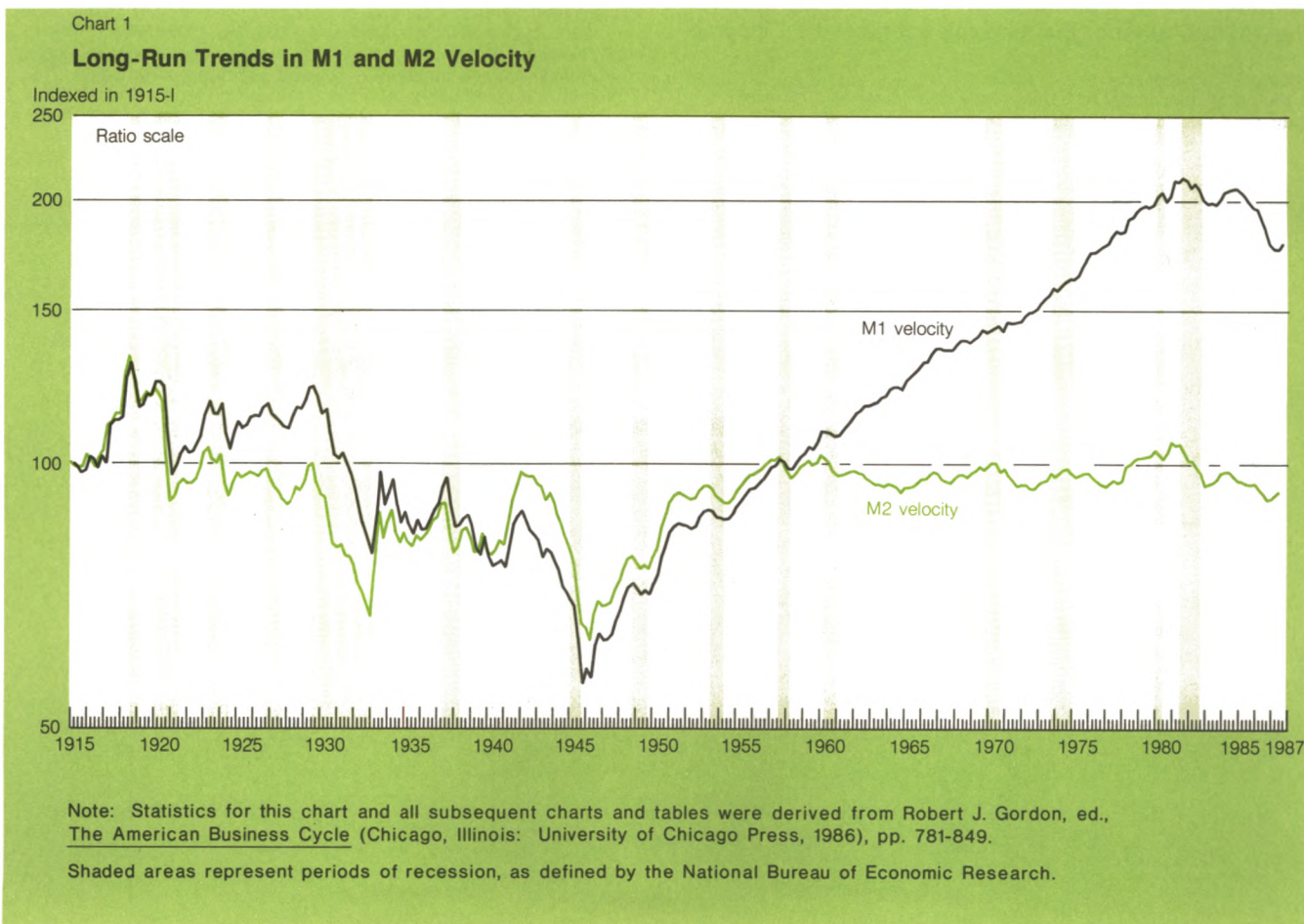
The first two equations contain the results for M1 and M2 over the entire period.⁶ Both equations appear to

⁶In a sense, these "standard money demand equations," which do not fully take into account the changes in the own rates on the components of M1 and M2 during the process of deregulation, should more properly be viewed as semi-reduced-form equations. For more detail on research efforts to account for changes in the rates offered on the components of M1 and M2, see George Moore, Richard Porter, and Dave Small, "Modelling and Disaggregated Demands for M1 and M2 in the 1980's: The U.S. Experience," a paper prepared for the Conference on Monetary Aggregates and Financial Sector Behavior in Interdependent Economies, sponsored

give reasonable results, especially considering both the overall length of the period and the difficulty of tracking M1 growth with conventional money demand equations in recent years. The coefficients on all of the independent variables are of the correct sign and are statistically significant. The short-run and long-run interest rate elasticities in the M2 equation are considerably smaller than those in the M1 equation.⁷ The M2 equation

Footnote 6 continued
by the Board of Governors of the Federal Reserve System, Washington, D.C., May 26-27, 1988.

⁷The long-run elasticity is calculated by dividing the short-run elasticity by one minus the coefficient on the lagged dependent variable. In theory, the value of the lagged dependent variable should be greater than zero but less than one. Within that range, the absolute value of the long-run elasticity will be larger relative to a given short-run elasticity the larger the value of the coefficient on the lagged dependent variable. The size of the coefficient on the lagged dependent variable can also be used to estimate how long it takes for the dependent variable to adjust to changes in the independent variables. For example, if quarterly statistics are used, a coefficient on the lagged dependent variable of 0.50 would mean



has a short-run income elasticity almost twice as large as the one contained in the M1 equation. However, the difference in long-run income elasticities is not very large: the long-run income elasticity for M2 is equal to one, while for M1 the value, at 0.85, is close to one. The only feature of these equations that seems somewhat questionable is the large values of the coefficients on the lagged dependent variables, values that imply a rather slow speed of adjustment (see footnote 7). In any case, these statistics suggest that over the last 70 years reasonable money demand equations have existed. Thus, the more interesting question seems to be, what has happened beneath the surface over some shorter time periods?

Equations for the three subperiods are shown in the lower part of Table 1. These equations also produce reasonable results, yielding coefficients that are statistically significant and of the correct signs. For the M1 demand equations, the 1950-73 period stands out because of rather low coefficients on both the income and interest rate variables (compared with the results for either the total period or other subperiods). And for the 1974-87 period, the long-run coefficient on income

of 1.47 seems very large, as does the short-run coefficient on the interest rate. In general, the demand for M1 appears to have become more sensitive since the mid-1970s to changes in interest rates and income than it was in the 1950-73 period. But the magnitude of this increased sensitivity appears to stem in part from the extremely low value of the coefficients in the 1950-73 period.⁸ Indeed, M1's velocity appeared stable over this period (around its rising trend) in part because the demand for M1 was relatively insensitive to shorter-run movements in interest rates.⁹

For the M2 demand equations, the short-run income and interest rate coefficients have been increasing over time, but because of the substantial decline in the

⁸More detail on the reasons for the increased interest sensitivity of the demand for M1 can be found in John Wenninger, "Responsiveness of Interest Rate Spreads and Deposit Flows to Changes in Market Rates," this *Quarterly Review*, Autumn 1986, pp. 1-10.

⁹William Poole also notes that postwar money demand (M1) functions usually have very low interest rate elasticities. For more information, see Poole, "Monetary Policy Lessons of Recent Inflation and Disinflation," National Bureau of Economic Research, Working Paper no. 2300, July 1987. See Judd and Scadding, "The Search for a Stable Money Demand Function," for a range of elasticity estimates for money demand functions estimated with the postwar data. The interest-rate coefficients reported there are quite low and on the same order of magnitude as the one shown in equation 4 in Table 1.

Footnote 7 continued

a period of adjustment of 2 quarters, a coefficient of 0.75 would indicate 4 quarters, and 0.90 would mean 10 quarters.

Table 1

Money Demand Equations

Dependent Valuable	In (Commercial Paper Rate)		In (Real GNP)		In (Lagged Real M1 or M2)	\bar{R}^2	D.W.	RHO	Sample Period
	Short-Run	Long-Run	Short-Run	Long-Run					
Total Period Equations									
(1) In (Real M1)	-0.0226 (5.7)	-0.359	0.054 (5.7)	0.857	0.937 (86.1)	0.99	2.0	0.26	1915-II to 1987-III
(2) In (Real M2)	-0.0142 (5.0)	-0.142	0.104 (5.5)	1.040	0.900 (48.6)	0.99	1.9	0.50	1915-II to 1987-III
Subperiod Equations									
(3) In (Real M1)	-0.0234 (4.2)	-0.257	0.095 (2.8)	1.044	0.909 (35.1)	0.99	2.0	0.35	1915-II to 1949-IV
(4) In (Real M1)	-0.0171 (4.3)	-0.182	0.045 (4.6)	0.479	0.906 (26.2)	0.95	2.0	0.32	1950-I to 1973-IV
(5) In (Real M1)	-0.032 (5.2)	-0.311	0.147 (6.1)	1.427	0.897 (28.7)	0.98	2.0	0.18	1974-I to 1987-III
(6) In (Real M2)	-0.0157 (2.9)	-0.160	0.097 (3.3)	1.000	0.902 (35.4)	0.99	1.9	0.47	1915-II to 1949-IV
(7) In (Real M2)	-0.0305 (5.8)	-0.169	0.230 (5.2)	1.278	0.820 (19.8)	0.99	2.1	0.53	1950-I to 1973-IV
(8) In (Real M2)	-0.0409 (5.4)	-0.135	0.359 (4.0)	1.181	0.696 (8.8)	0.98	2.2	0.55	1974-I to 1987-III

coefficient on the lagged dependent variable, the long-run elasticities have not increased over time (see footnote 7). Hence, in contrast to M1, the overall sensitivity of M2 to changes in interest rates and income has not increased, although the distributions of these responses over time probably have become considerably shorter. Indeed, in terms of long-run coefficients, it appears that the demand for M2 has recently become less sensitive to movements in interest rates than it was in earlier years.¹⁰ This development makes intuitive sense. The recent elimination of interest rate ceilings on most of the components of M2 has enabled banks to retain deposits more effectively by increasing deposit rates in step with increases in market rates. Consequently, we would expect the demand for M2 to show less sensitivity to changes in market interest rates.

Money demand errors over the 1915-87 period

This section analyzes the error patterns from the equations estimated in the previous section. This exercise will provide some additional perspective on money demand stability over time and on the relative stability of the demand for M1 and M2. Chart 2 (upper panel) shows the errors (that is, actual minus predicted levels as a percent of the actual levels) from the total period M1 equation for both dynamic and static in-sample simulations. Because the equation is put on track each quarter in calculating the next quarter's value of M1, the static simulation shows considerably smaller errors than the dynamic simulation in which errors are allowed to accumulate over time.¹¹ The bottom panel of Chart 2

shows an alternative calculation of the errors on a year-by-year basis (see footnote 11).

As we would expect from the stable trend in velocity shown in Chart 1 for the 1950-73 period, the errors over this period appear to be the smallest in the entire sample. For the dynamic simulation, however, the errors tend to be uniformly positive during this period. In addition to showing the large negative errors in the demand for money in the mid-1970s (which in the 1980s have been more than entirely reversed), the dynamic simulation suggests that there were other periods of substantial instability in money demand, that is, errors in excess of 10 percent.¹² The dynamic simulation for the interval from the late 1920s to the early 1940s, for example, also shows large negative errors, suggesting a period of unusually weak M1 growth even more pronounced than the one that began in the mid-1970s. In terms of individual years, 1933 and 1937 show particularly large negative errors during the period from the late 1920s to 1940 (bottom panel of Chart 2).¹³

Chart 3 contains comparable simulations for M2. The dynamic simulation suggests that M2 did not have a period of unusually weak growth in the mid 1970s comparable to the slowdown in M1. But M2 apparently was quite weak relative to the equations' predicted values from the early 1950s to the early 1960s—the period when the velocities of M1 and M2 began to diverge (Chart 1). The dynamic M2 simulation, in contrast to the M1 simulation, does not suggest the possibility of large, sustained negative errors in the demand for money from the late 1920s to the early 1940s. The years 1933 and 1937, however, show large negative errors, as they did in the M1 simulation (bottom panel of Chart 3). In any case, it appears that the interpretation of events during those years depends in part on

¹⁰Richard G. Davis, Leon Korobow, and John Wenninger use bankers' pricing strategies to explain this declining sensitivity in "Bankers on Pricing Consumer Deposits," this *Quarterly Review*, Winter 1987, pp. 6-13.

¹¹For many econometric exercises that extend for more than one quarter into the future, the dynamic or cumulative errors are of more interest because the value of the lagged dependent variable estimated by the equation is used rather than the actual value. In a sense, these dynamic, in-sample errors answer the following question: If we knew in advance what the total period money demand equation would be, and we used it to simulate various subperiods (beginning whenever the actual value equals the predicted value), what would the underlying error pattern have been? Therefore, the static and dynamic errors represent the two extreme ways of looking at the errors from a money demand equation with a lagged dependent variable. An intermediate way of examining the error patterns would be to do a series of dynamic simulations over a fixed number of quarters—for example, the four quarters of a calendar year—using the actual value of the lagged dependent variable from the final quarter of each preceding year. For more detail, see John Wenninger, Lawrence J. Radecki, and Elizabeth Hammond, "Recent Instability in the Demand for Money," this *Quarterly Review*, Summer 1981, pp. 1-9. The lower panels of Charts 2 and 3 present the errors calculated in this way, that is, for successive one-year periods. As expected, this calculation produces results less volatile than those from the dynamic simulation but more pronounced than those from the static simulation. Although the discussion in the text focuses principally on conventionally calculated dynamic and static errors, the reader should keep in

Footnote 11 continued

mind that the procedure used to calculate errors when an equation includes a lagged dependent variable can shade the picture.

¹²The 10-percent criterion for calling dynamic simulation errors "substantial" was set arbitrarily, but does not seem unreasonable. When the error reached 10 percent in the mid-1970s, economists undertook extensive research on the reason for the shift. For more detail, see footnote 4.

¹³For a more detailed analysis of that period and reasons why the demand for M1 might have been unstable in 1933, see Charles Lieberman, "The Long-Run and Short-Run Demand for Money Revisited," *Journal of Money, Credit and Banking*, vol. 12 (February 1980), pp. 43-57. Also see Arthur E. Gandolfi, "Stability of the Demand for Money During the Great Contraction, 1929-1933," *Journal of Political Economy*, vol. 82 (October 1974), pp. 969-83; Arthur E. Gandolfi and James R. Lothian, "The Demand for Money from the Great Depression to the Present," *American Economic Review*, vol. 66 (Papers and Proceedings of the 88th Annual Meeting of the American Economic Association, December 1975), pp. 46-51; and Arthur E. Gandolfi and James R. Lothian, review of *Did Monetary Forces Cause the Great Depression?* by Peter Temin, *Journal of Money, Credit and Banking*, vol. 9 (November 1977), pp. 679-91.

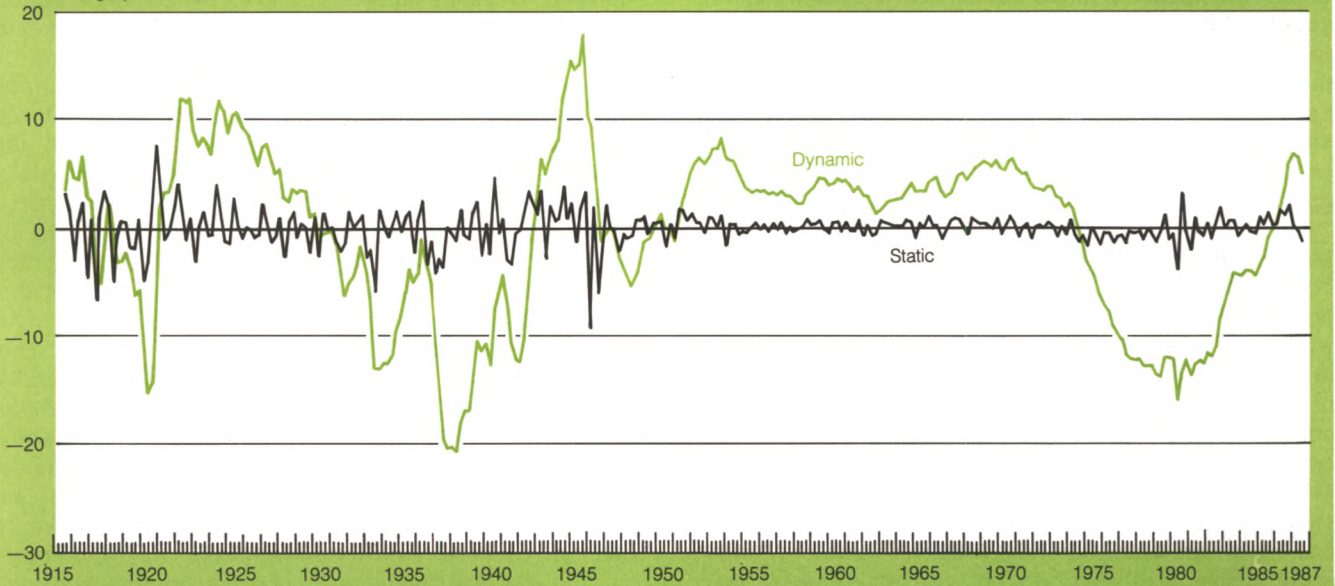
Chart 2

Alternative Measures of Money Demand Errors (M1)

Errors from In-Sample Dynamic and Static Simulations

Error as Percent of Actual

Percentage points



Errors from a Series of One-Year Dynamic Simulations

Error as Percent of Actual

Percentage points

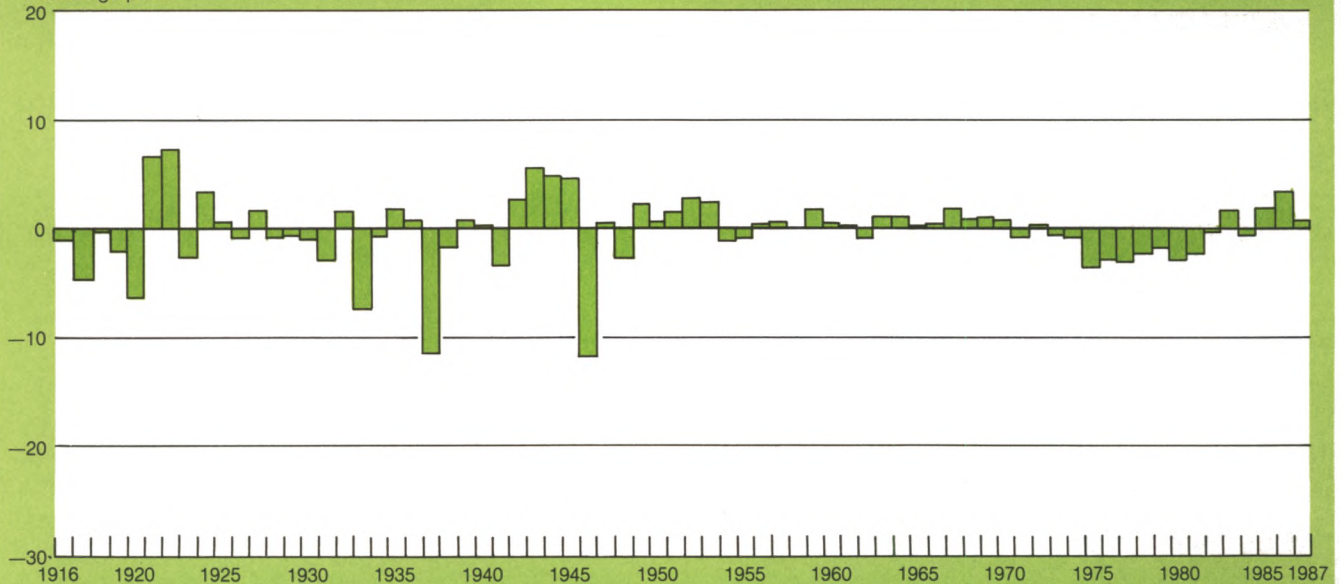
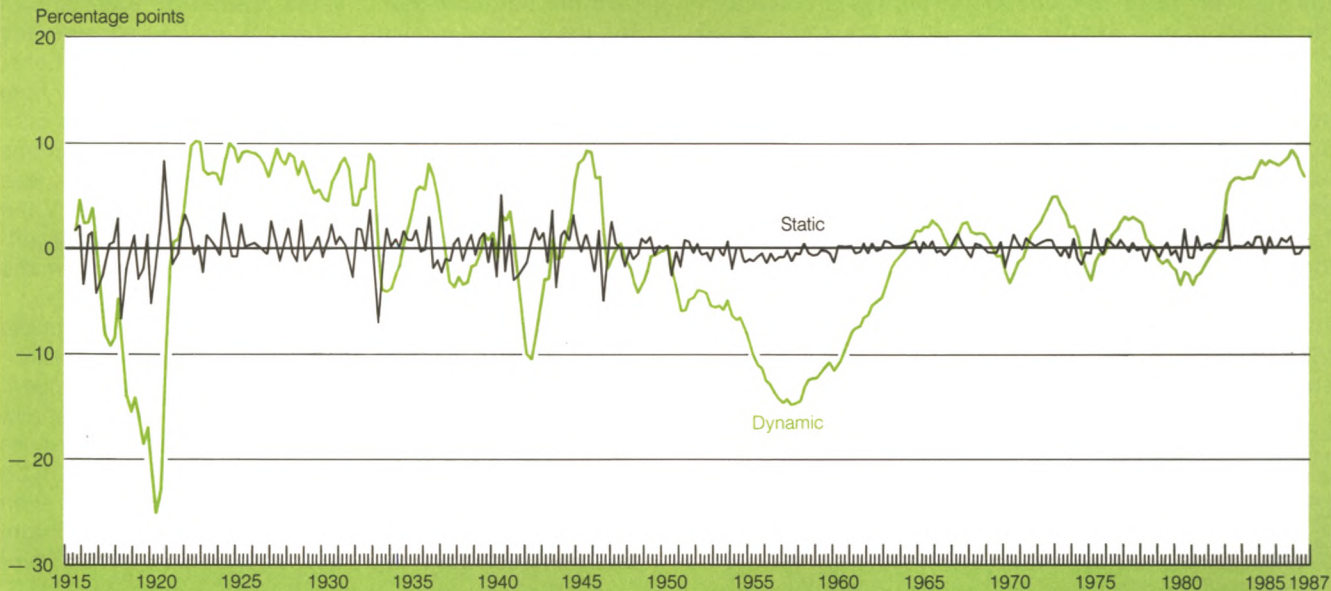


Chart 3

Alternative Measures of Money Demand Errors (M2)

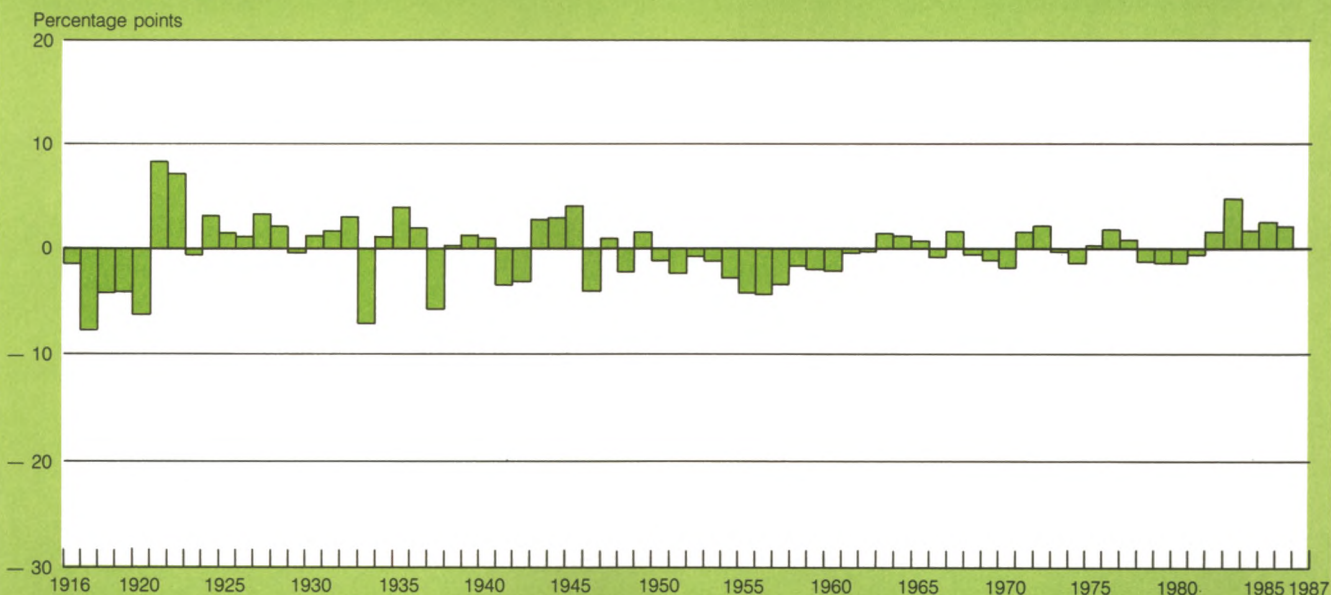
Errors from In-Sample Dynamic and Static Simulations

Error as Percent of Actual



Errors from a Series of One-Year Dynamic Simulations

Error as Percent of Actual



the monetary aggregate selected.¹⁴ (In the final section, we will examine the stability of coefficients during that period.) By and large, the M2 equation does not seem to show as many substantial errors (errors in excess of 10 percent in the dynamic simulation) as the M1 equation displays.

The underlying error patterns can be explored more carefully across subperiods using the statistics in Table 2. This table contains the errors (as a percent of the actual money supply series) from the total-period equations in the upper part and from the subperiod equations in the lower part. Looking first at the total-period results, we find that the dynamic and static simulations for M1 show by far the smallest average absolute and root mean squared errors over the 1950-73 period—a conclusion that had been evident from Charts 1 and 2. There is, however, a large average error during this period of 3.8 percentage points for the dynamic simulation, which declines to -6.7 percentage points in the following time period. For the total-period dynamic M2 simulation, in contrast, the smallest average absolute and root mean squared errors have tended to occur in

the most recent period, and these measures of the M2 errors are also considerably smaller than the comparable measures of the M1 errors for this period. In addition, the average error for M2 is considerably smaller in absolute value than the average error for M1. Again, these statistics suggest that the demand for M2 has been more stable relative to the total-period estimates than has the demand for M1 in recent years.

In the bottom panel of Table 2, the errors are shown for the money demand equations estimated over the three subperiods. For both the M1 and M2 equations, the average absolute and root mean squared errors from the dynamic simulations have tended to decline considerably for the two later time periods when equations are fitted for the individual subperiods. For M1, this was particularly true for the 1974-87 period. Apparently the changes in the elasticities that occurred over the different sample periods (Table 1) can help explain the quarter-to-quarter movements in money demand.

The discussion thus far has concerned in-sample errors, and we need to determine whether the instability in money demand over the 1974-87 period would appear much different if we used out-of-sample errors. Normally, out-of-sample errors would be expected to be more pronounced because the coefficients would not be affected by the statistics contained in the simulation period. To see how important this consideration might be, we calculated average out-of-sample errors over

¹⁴If one major cause of the large negative errors for the M1 demand equation during that period was the prohibition of interest on demand deposits, then it would not be surprising to see large, sustained negative errors for M1 demand, but not for M2 demand, if consumers shifted funds previously held in demand deposits into time deposits. For more detail, see Lieberman, "The Long-Run and Short-Run Demand for Money Revisited."

Table 2

In-Sample Money Demand Errors
(As a Percent of Actual)

	Total Period M1								Total Period M2							
	Dynamic				Static				Dynamic				Static			
	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)
Average	-0.5	-1.0	3.8	-6.7	0	-0.1	0.2	-0.2	-0.4	1.0	-4.2	2.4	0	0	-0.2	0.2
Average absolute	6.2	7.2	3.8	7.9	1.2	1.8	0.5	0.9	5.3	5.9	5.4	3.7	1.1	1.6	0.6	0.6
Root mean squared	7.6	8.7	1.7	6.3	1.8	2.4	0.6	1.1	6.9	7.4	5.7	4.0	1.6	2.1	0.7	0.8
	Subperiod M1								Subperiod M2							
	Dynamic				Static				Dynamic				Static			
	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)	(1915-87)	(1915-49)	(1950-73)	(1974-87)
Average	-0.2	-0.4	0.1	-0.2	0	0	0	0	-0.1	-0.3	0.2	0.1	0	0	0	0
Average absolute	3.7	5.7	1.7	2.3	1.2	1.8	0.5	0.7	3.9	6.1	2.0	1.7	1.0	1.6	0.5	0.5
Root mean squared	5.1	7.1	2.0	2.7	1.7	2.4	0.6	1.0	5.6	7.8	2.4	2.1	1.5	2.1	0.6	0.8

the two time periods since the mid-1970s suggested previously by the in-sample simulation—the unusually weak growth in M1 from 1974 to 1980 and the period of generally rapid growth from 1981 to 1987 (Chart 2). The results are shown in Table 3. Roughly the same patterns and magnitudes of instability that appeared in the in-sample simulations (top row) also occurred in the out-of-sample simulations (rows 2 through 5), suggesting that the sample period was sufficiently long that the results were not very sensitive to whether the simulation over the 1974-87 period was in-sample or out-of-sample. The results in Table 3 also confirm the greater stability in the demand for M2 over the 1974-87 period that was noted earlier on an in-sample basis.

Analyzing the errors from the M1 and M2 equations can help clarify one further issue: To what extent have the same factors caused instability in the demand for M1 and for M2 on a quarter-to-quarter basis? A high correlation of the errors from the M1 and M2 equations would support the presumption that certain factors have contributed to the instability in the demand for both functions. One such factor might be the development of new instruments that are attractive substitutes for both M1 and time deposits. If, on the other hand, the errors were not correlated, then it could be that much of the instability in the demand for M1 is caused by shifts of funds into and out of nontransactions M2, or that some of the factors that affect the demand for time deposits do not affect the demand for M1. From a policy perspective, of course, uncorrelated errors would be preferred; such findings would suggest that M1 and M2 are good complements, enabling analysts to check the accuracy of one as an indicator by looking at the performance of the other.

Table 4 contains the results of regressing the errors

(in growth terms) from the M2 equations on the comparable errors for the M1 equations for both the dynamic and static simulations. By and large, the results suggest that the errors have become less correlated in the 1974-87 period and that M1 and M2 have been more useful complements for policy purposes. Relative to the 1950-73 period, the R^2 has dropped by at least 50 percent, regardless of whether dynamic or static simulations were used or whether the total-period equation or the equations for subperiods were simulated.

Changes in money demand coefficients over time

In this final section, we explore in more detail how the individual parameters in the money demand equations have evolved over time. Breaking an extended sample period into a limited number of shorter-run periods to observe changes in coefficients or predictive accuracy is arbitrary unless it is possible to point to some specific occurrence that should have affected the stability of the demand equations. In Section I, we used a judgmental approach to identify possible breaking points approximately, but checking those results with some other technique would still be useful.

As a result, we have taken another approach in this section. We estimated money demand equations for

Table 3

Comparison of Average Errors for Dynamic Simulations: 1973-87

(Quarterly Growth Rates)*

Estimation Period	M1		M2	
	1974-80	1981-87	1974-80	1981-87
(1) 1915-87	-1.7	2.6	-0.4	1.4
(2) 1915-73	-2.7	2.2	0.3	1.5
(3) 1915-80	n.a.	1.7	n.a.	1.6
(4) 1950-73	-1.7	3.0	-0.9	0.1
(5) 1950-80	n.a.	3.3	n.a.	-0.2

*The first simulations (for M1 and M2) are the dynamic in-sample simulations shown in Charts 2 and 3 from equations (1) and (2) in Table 1. The remaining simulations are dynamic out-of-sample simulations.

Table 4

Correlation between Errors from M1 and M2 Equations

(Quarterly Growth Rates)*

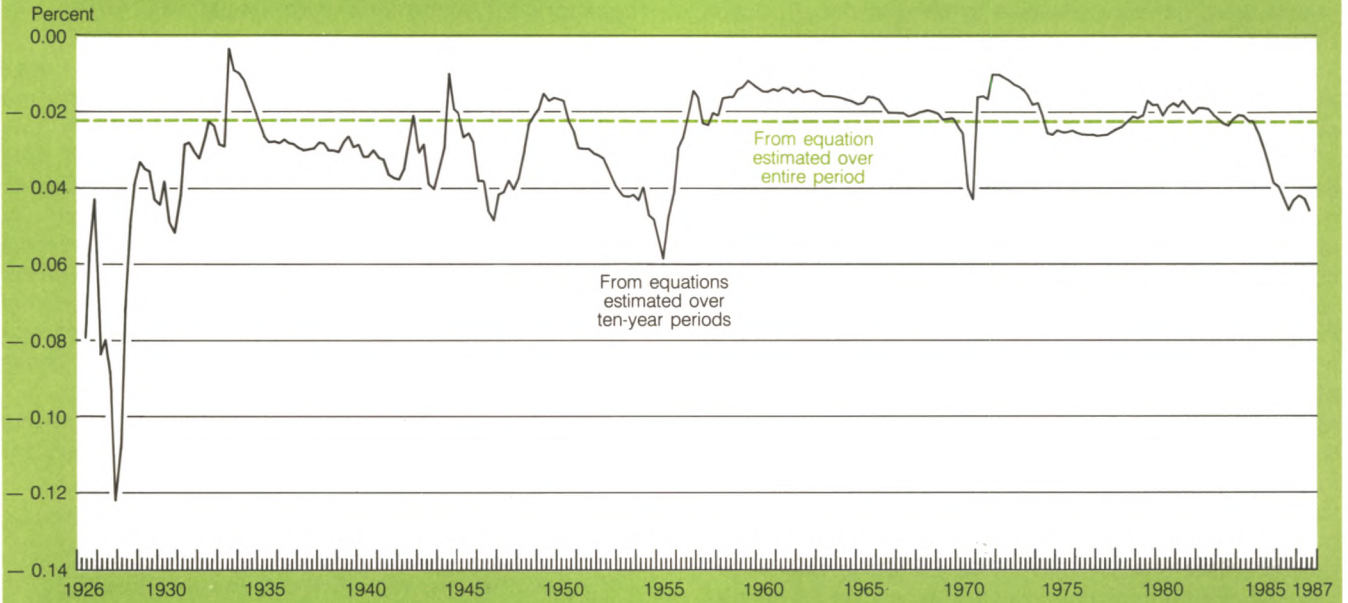
	Coefficient (t-statistic)	\bar{R}^2
Total period equations		
Dynamic		
1915-49	0.75 (16.1)	0.66
1950-73	0.88 (16.9)	0.75
1974-87	0.44 (5.3)	0.35
Static		
1915-49	0.69 (12.4)	0.54
1950-73	0.90 (18.3)	0.78
1974-87	0.46 (5.4)	0.36
Subperiod equations		
Dynamic		
1915-49	0.76 (16.9)	0.68
1950-73	0.86 (16.2)	0.74
1974-87	0.43 (5.1)	0.34
Static		
1915-49	0.68 (12.7)	0.54
1950-73	0.91 (17.5)	0.77
1974-87	0.46 (5.4)	0.36

*Errors were calculated as the difference between the actual and predicted quarterly growth rates. The in-sample errors from the M2 equations were regressed on the in-sample errors from the M1 equation. Adjustment was made for autocorrelation.

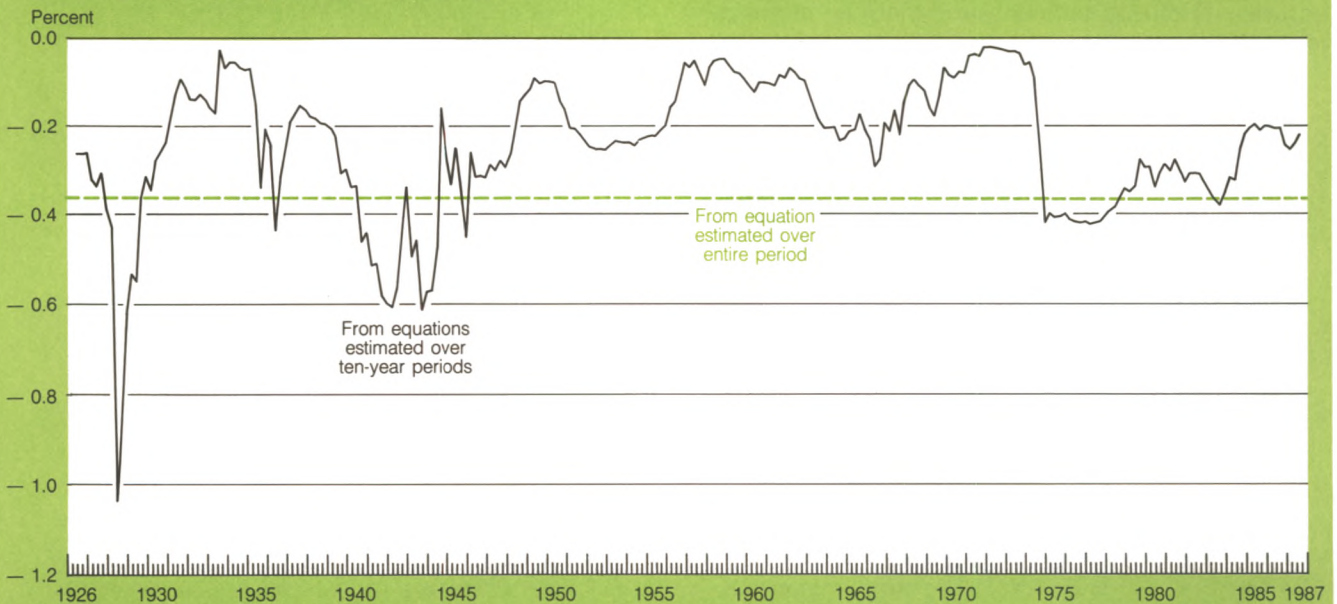
Chart 4

Comparison of Total-Period and Successive Ten-Year Coefficients

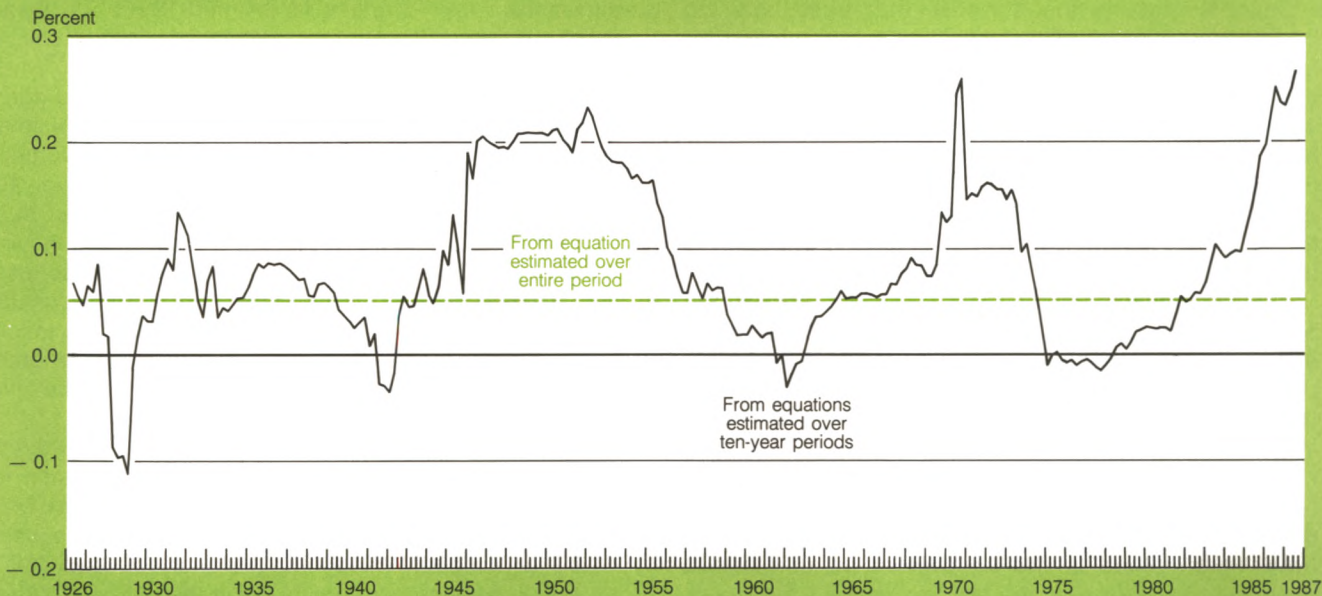
M1 Short-Run Interest Rate Elasticity



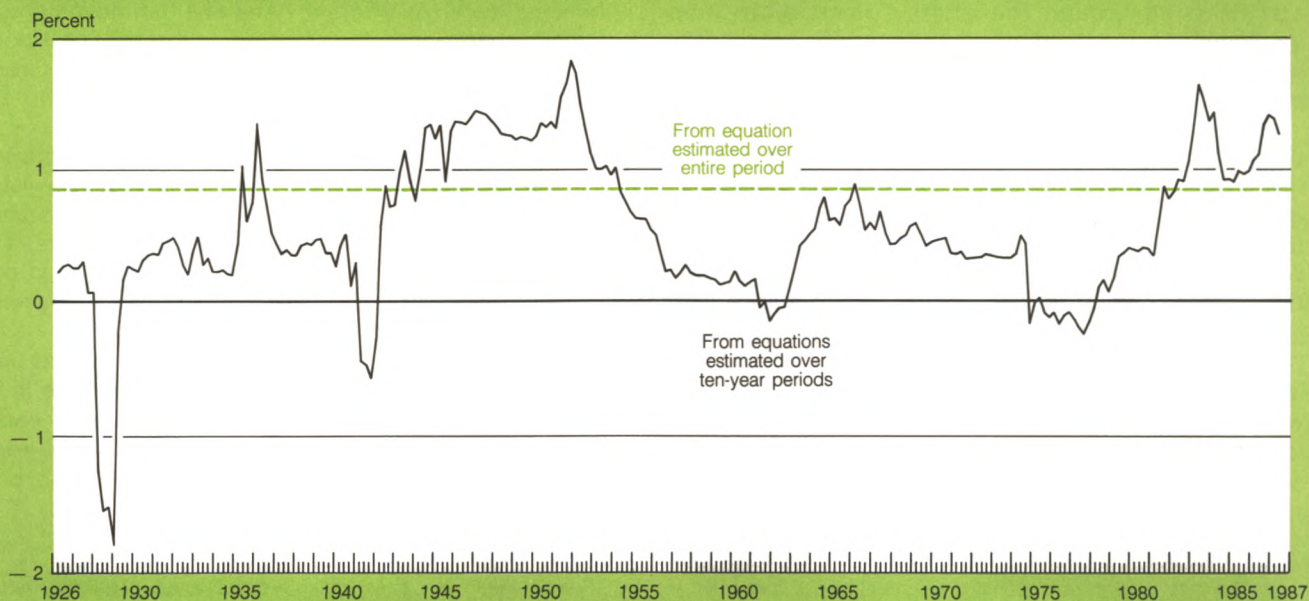
M1 Long-Run Interest Rate Elasticity



M1 Short-Run Income Elasticity



M1 Long-Run Income Elasticity



successive 10-year periods, dropping and adding one observation each time the equations were reestimated, for a total of 243 regressions for M1 as well as for M2. The coefficients were then recorded for each regression and plotted over time to obtain some rough idea of how these coefficients have evolved. These results, in turn, can be used to evaluate further some of the more recent changes noted earlier, such as the increased interest-rate coefficient in the demand for M1.¹⁵

Chart 4 contains the statistics that trace how the income and interest rate elasticities in the demand for M1 have evolved over time compared with the elasticities estimated over the entire sample period. In absolute value, the short-run interest rate and income elasticities have increased substantially since the mid-1970s (upper part of chart). Indeed, the short-run income elasticity appears to be at one of the highest levels ever attained for a 10-year period. These results were also apparent from Table 1.

When we look at the long-run elasticities (bottom part of chart), the differences relative to the total-period estimates do not appear quite as dramatic. Changes in the coefficient on the lagged dependent variable (Chart 6) have tended to offset some of the movement in the short-run coefficients in recent years. The estimate of M1 demand over the entire 1974-87 period (equation 5 in Table 1) tended to conceal the downward drift towards a more reasonable value that seems to have taken place in the coefficient on the lagged dependent variable over the last few years. As a result, it appears that M1's long-run interest rate elasticity has declined somewhat (in absolute value) since the mid-1970s, even though the short-run elasticity has increased. The long-run elasticity, however, is still considerably larger than it was over the 1950-73 period on average.

A rising short-run interest rate elasticity and a declining long-run elasticity in recent years seem consistent with current banking practices. Initially, when market rates increase, banks have tended not to change the rate on NOW accounts, thereby enlarging rate spreads that induce consumers to shift funds out of M1. Over time, however, if the increase in the market rate persists, banks will gradually adjust the NOW-account rate upward, matching at least part of the market-rate increase. Hence, some of the shift out of NOW accounts will be reversed. And since there is at least some flexibility in the NOW account rate compared with the earlier situation when rates were regulated, the long-run elas-

ticity might decline.¹⁶

For all the M1 elasticities, very sharp downward movements occurred around 1929, suggesting instability in the demand for M1 about the time of the Great Depression. Some instability at that time was also apparent in the error pattern for the total-period equation (Chart 2), implying that the extreme fluctuations in economic activity in the late 1920s and early 1930s contributed to money demand instability. The coefficients also show large changes in the mid-1970s as observations covering the well-documented downward shift in money demand at that time are included.

In general, the results from Chart 4 do not suggest that the changes that have occurred in the coefficients in the demand for M1 function in recent years have been unprecedented by past standards. Measured over 10-year periods, these coefficients have changed substantially at other times in the past, occasionally moving outside the range of values suggested as reasonable by economic theory. In particular, the negative values obtained at times for the income elasticities are inconsistent with economic theory, since consumers generally are expected to add to their money balances as the level of income increases.

The comparable results for M2 are shown in Chart 5. The short-run interest rate coefficient in the demand for M2 has been quite stable in recent years. However, M2's long-run interest rate coefficient has declined considerably in absolute value during the 1970s and 1980s as many consumer deposits have been deregulated. Similarly, M2's short-run income elasticity has increased sharply in recent years, but the long-run coefficient remains quite close to one. And like the movements in the M1 coefficients, the changes in the M2 coefficients in recent years do not appear to be totally unprecedented by past standards. The M2 coefficients have also drifted over fairly wide ranges in the past.

In addition, M2's short-run and long-run income and interest rate coefficients also take on values inconsistent with economic theory around 1929, displaying the same extreme instability evident in the M1 coefficients. This finding also suggests that extreme fluctuations in economic activity can affect the stability of money demand. Overall, judging from the sharp movements in the coefficients in both the M1 and M2 equations at that time, it appears that money demand was quite unstable in the late 1920s and early 1930s, although as noted earlier this instability did not show up as clearly in the errors from the dynamic M2 simulation as it did in the error pattern from the M1 simulation (Charts 2 and 3).

Chart 6 contains the movements in the constant terms

¹⁵Other studies have noted that the coefficients in the money demand equations can differ depending on the sample period selected but have not attempted to show how the coefficients have varied over time. For more detail, see Stephen M. Goldfeld, "The Demand for Money Revisited," *Brookings Papers on Economic Activities*, no. 3 (1973), pp. 577-646.

¹⁶For more detail, see Wenninger, "Responsiveness of Interest Rate Spreads"; and Davis, Korobow, and Wenninger, "Bankers on Pricing Consumer Deposits."

and the coefficients on the lagged dependent variables. It is well known that the coefficient on the lagged dependent variable in M1 equations (left side of chart) increased dramatically at the time of the downward shift in the demand for M1 in the mid-1970s, actually exceeding one for a period of time.¹⁷ Economic theory suggests this coefficient should be between zero and one (see footnote 7). More recently, however, that coefficient appears to have returned to a more reasonable value and is about 10 percent below the coefficient for the entire time period.

In contrast, the constant term in the M1 equations does not appear to be returning to a more reasonable value. It has continued to shift sharply downward, suggesting that variables other than those included in the equation have been affecting the demand for M1. And unlike many of the other movements in the coefficients over time, the downward drift in the constant term is almost beginning to appear unprecedented. Since this downward drift began in the mid-1970s, it could well reflect the increased emphasis on cash management that began at that time. However, since the constant term reflects the net of several factors that could be affecting the demand for M1, it is difficult to know whether cash management provides a com-

¹⁷In calculating the long-run elasticities, we used the total-period coefficient on the lagged dependent variable whenever the short-run coefficient exceeded the coefficient for the total period. The total-period coefficient was already close to one, and dividing short-run coefficients by numbers close to zero (or even negative numbers) produced charts that were very difficult to interpret.

plete explanation.¹⁸

Table 5 contains a brief summary of the results in Charts 4, 5, and 6, focusing specifically on the money demand coefficients estimated over the most recent 10-year (1977-87) period compared with the average coefficients estimated over successive 10-year periods. The large standard deviations of the coefficients relative to the estimated values again illustrate the substantial degree to which these coefficients have shifted over time, making the recent experience appear somewhat less unusual. The most notable exception, as noted earlier at an impressionistic level, is the constant term in the M1 equation. It currently stands more than two standard deviations from the mean, suggesting that M1 has been strongly influenced in recent years by factors other than the conventional interest rate and income variables. The other exception is the short-run income elasticity in the M1 equation. One possible interpretation of the large coefficient estimated for recent years is that as income grows, consumers are adding funds to M1 not only for transactions purposes but also for savings purposes now that M1 contains an interest-earning component, NOW accounts.¹⁹

¹⁸The results in Chart 6 for M2 (right side of chart) are not so striking. The constant term has been drifting downward but not out of line with what has occurred before. The coefficient on the lagged dependent variable has been declining since the mid-1970s and is now generally in the same range as the coefficient from the M1 equation, suggesting roughly similar speeds of adjustment in the demand for M1 and M2 balances at this time.

¹⁹While some of the changes in the other coefficients in the M1 and M2 demand equations are not as dramatic as the two just

Table 5

Money Demand Coefficients

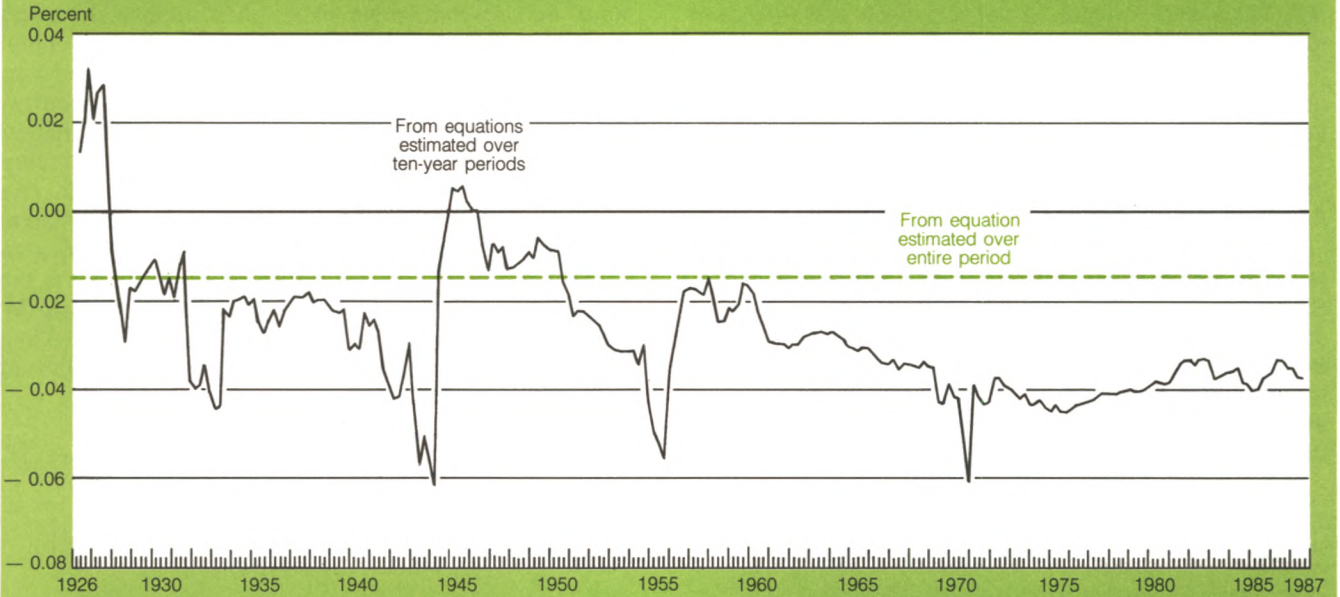
	Constant Term	Commercial Paper Rate		Income		Lagged Dependent Variable
		Short-Run	Long-Run*	Short-Run	Long-Run*	
M1						
Last 10 years (1977-III to 1987-III)	-1.709	-0.046	-0.219	0.266	1.266	0.790
Mean of 10-year periods	-0.383	-0.028	-0.240	0.096	0.656	0.836
Standard deviation (entire period)	0.467	0.015	0.151	0.067	0.436	0.108
M2						
Last 10 years (1977-III to 1987-III)	-1.512	-0.038	-0.146	0.293	1.133	0.741
Mean of 10-year periods	-0.716	-0.030	-0.188	0.175	1.050	0.824
Standard deviation (entire period)	0.597	0.012	0.095	0.063	0.378	0.072

*See footnote 17 in text for method used to calculate long-run elasticities for those quarters in which there were unusually large coefficients on the lagged dependent variable. When these calculations were made, those observations were dropped that had coefficients inconsistent with economic theory, i.e., negative income elasticities, positive interest rate elasticities, or coefficients on the lagged dependent variable equal to or greater than one. The results, however, were not very sensitive to whether or not these observations were included.

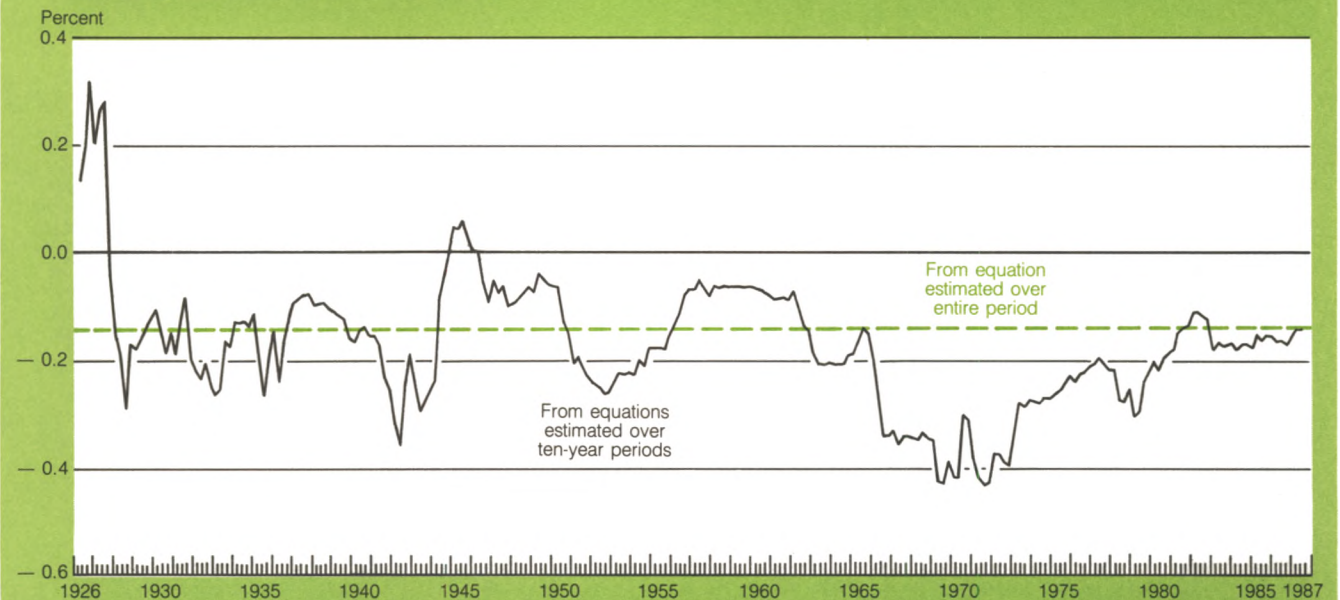
Chart 5

Comparison of Total-Period and Successive Ten-Year Coefficients

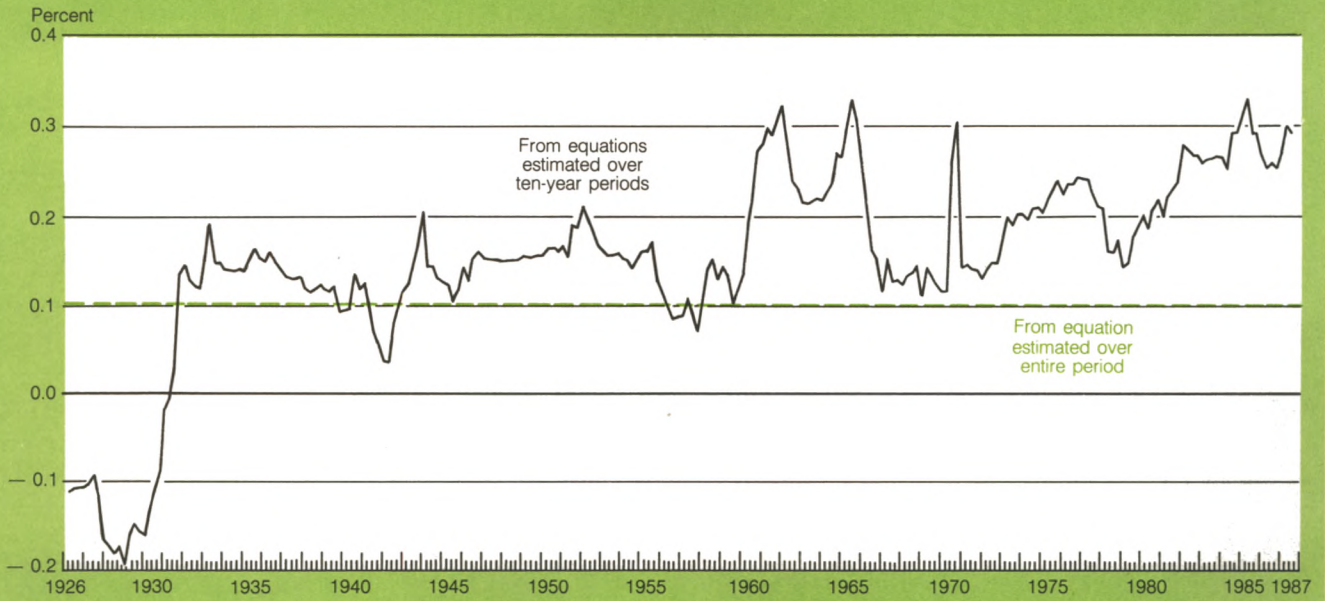
M2 Short-Run Interest Rate Elasticity



M2 Long-Run Interest Rate Elasticity



M2 Short-Run Income Elasticity



M2 Long-Run Income Elasticity

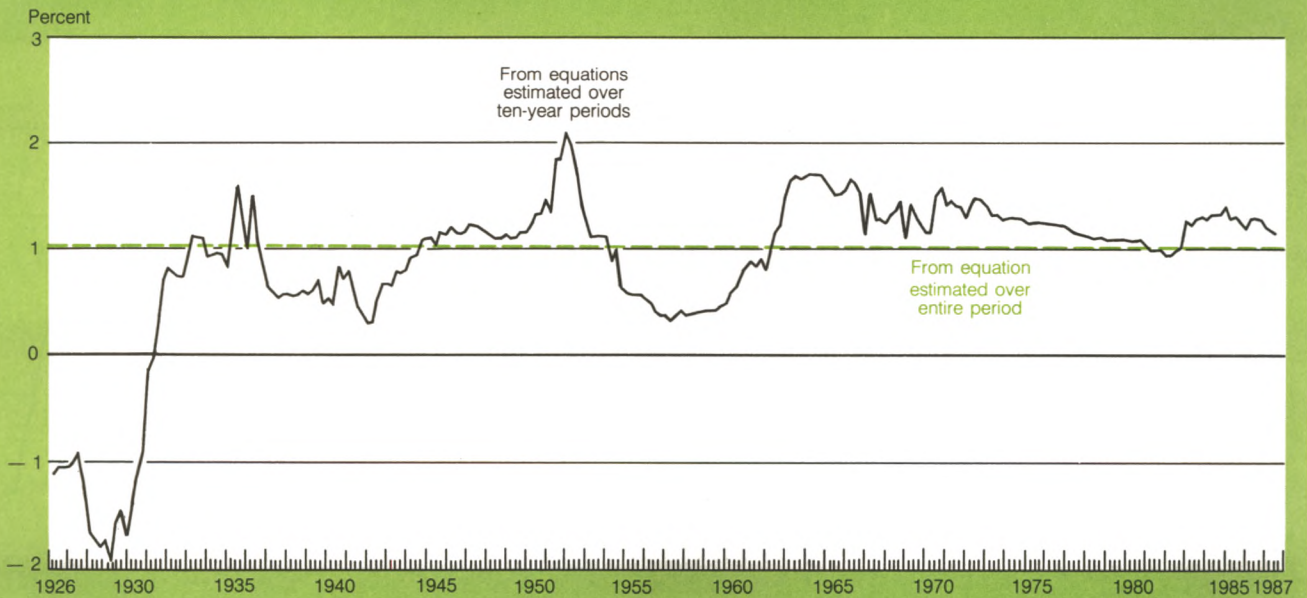
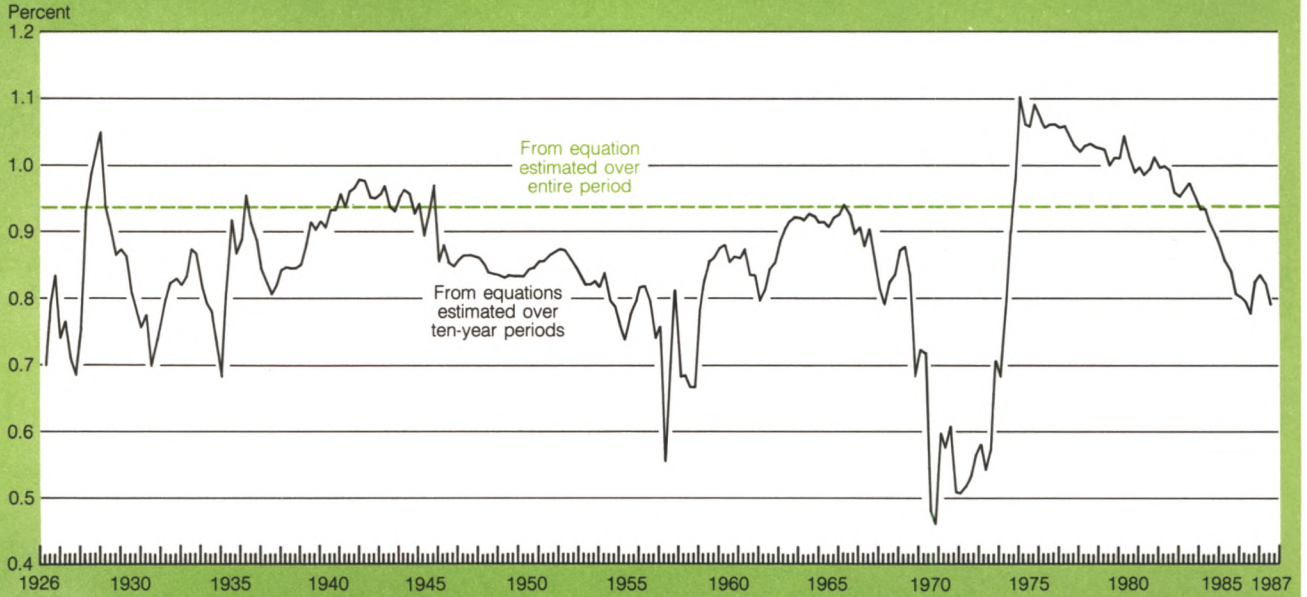


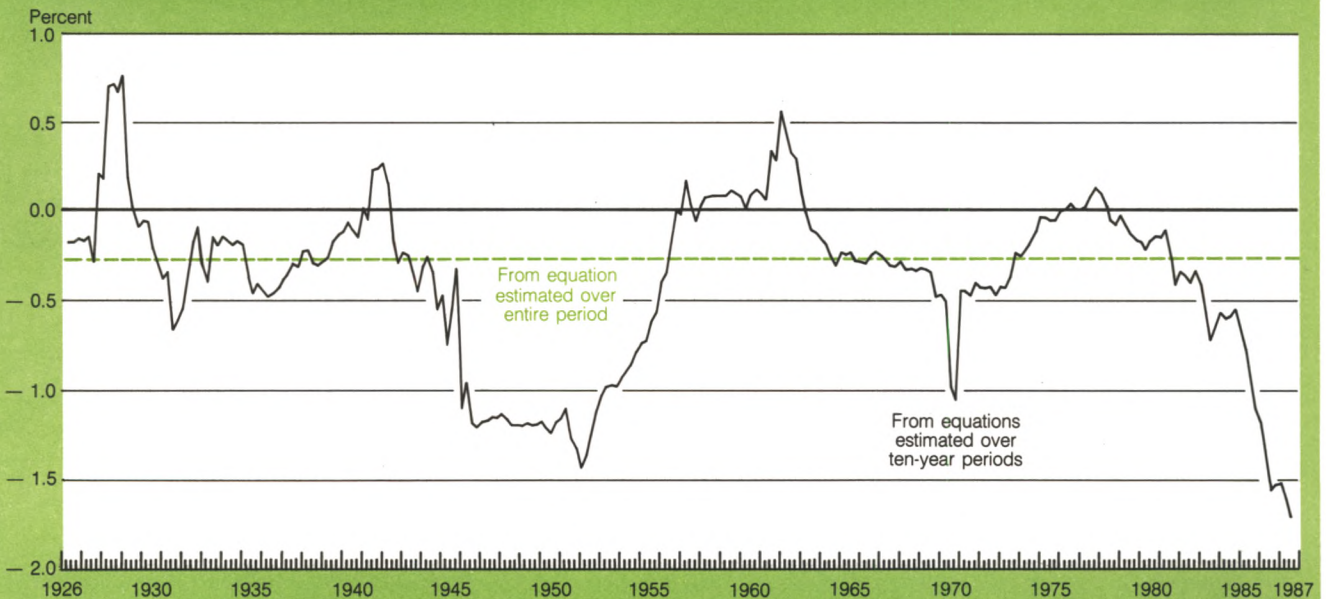
Chart 6

Comparison of Total-Period and Successive Ten-Year Coefficients

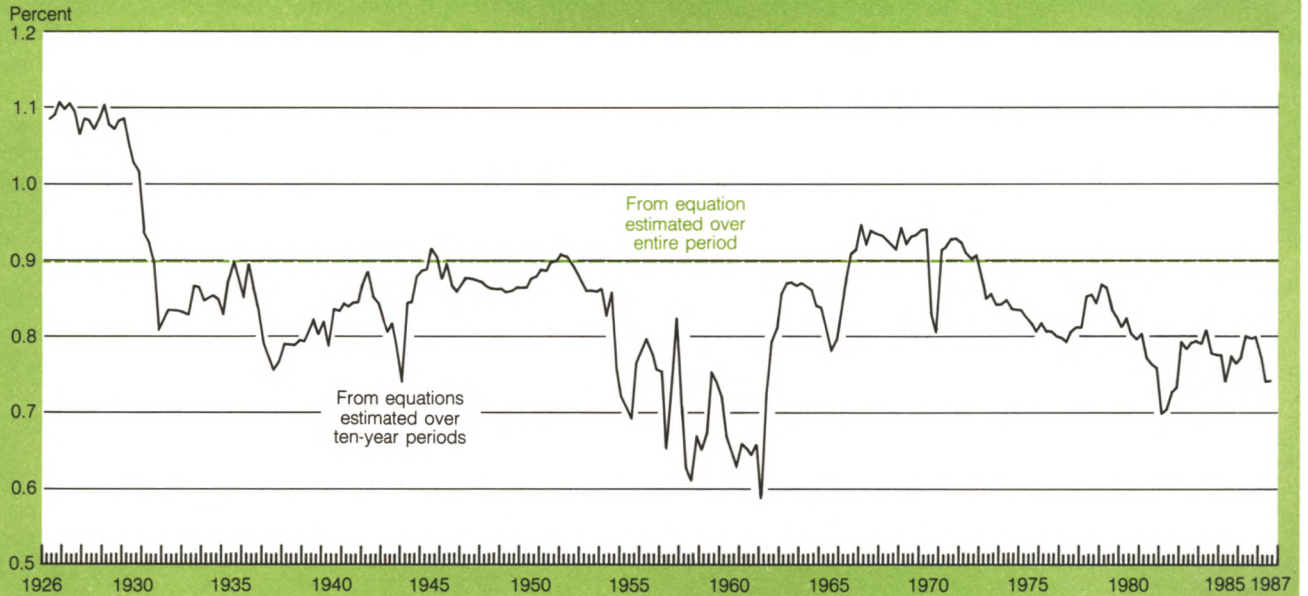
M1 Lagged Dependent Variable



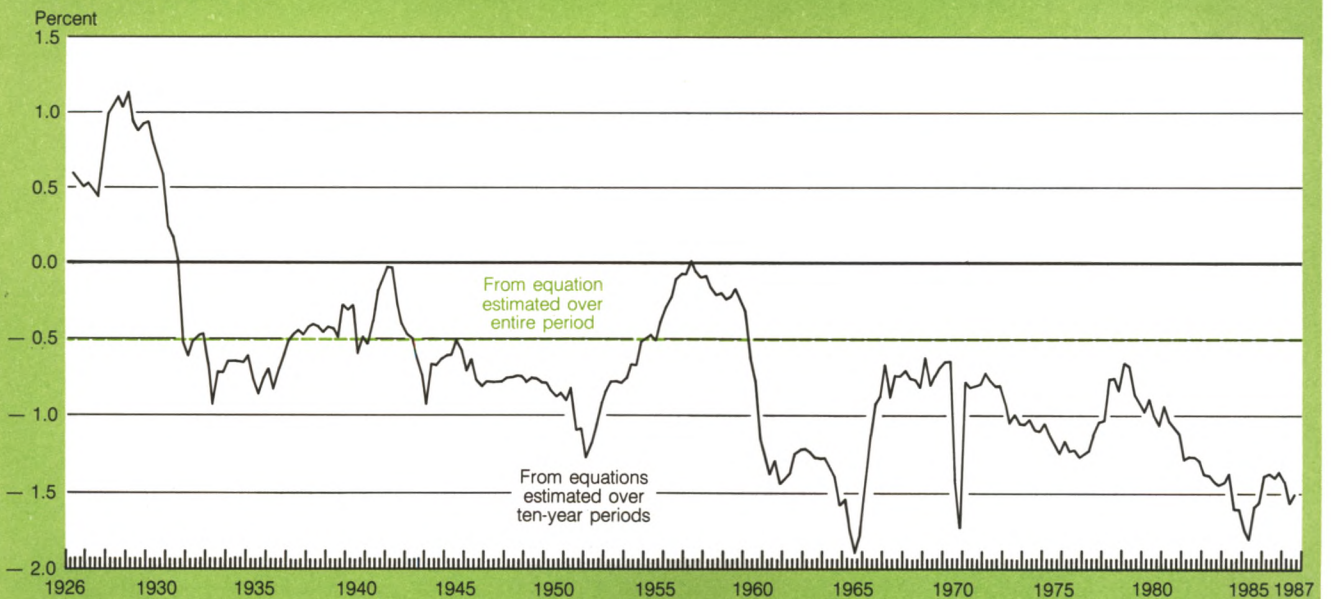
M1 Constant Term



M2 Lagged Dependent Variable



M2 Constant Term



Conclusions

In this article, we have attempted to put the recent instability in the demand for M1 into a broader context—first, by examining money demand over several decades, and second, by exploring the demand for M1 relative to the demand for M2. At the same time, we have avoided a detailed inquiry into the reasons why money demand has been unstable in recent years, since earlier studies have explored these issues at length.²⁰ Our chief purpose has been to show that the stable demand for M1 over the 1950-73 period was a rather unique experience. Longer term results reveal a more persistent pattern of instability in the demand for M1.

Footnote 19 continued

mentioned, some of them are, of course, still large enough to have substantial effects on the predicted growth of the monetary aggregates. In particular, the short-run interest rate coefficient for M1, the long-run income elasticity for M1, the constant term for M2, and the short-run income elasticity for M2 have shown rather large changes.

²⁰See, for example, John Wenninger and Thomas Klitgaard, "Exploring the Effects of Capital Movements on M1 and the Economy," this *Quarterly Review*, Summer 1987, pp. 21-31. For a comprehensive survey of the various explanations for the decline in M1's velocity during the 1980s, see Courtenay C. Stone and Daniel L. Thornton, "Solving the 1980s' Velocity Puzzle: A Progress Report," Federal Reserve Bank of St. Louis *Review*, August-September 1987, pp. 5-23.

The demand for M1 over the 1950-73 period was also unique because of the rather low coefficients in absolute value estimated for the interest rate and income variables relative to the coefficients estimated for earlier and later time spans and relative to the results for the entire period. This finding suggests that the estimates of the demand for money over this period were not representative of the demand for money more generally.

In recent years, the demand for M2 appears to have been somewhat more stable than the demand for M1. In addition, the demand for M2 appears to have become less sensitive to changes in market interest rates since the mid-1970s. On a quarter-to-quarter basis, the errors from the M1 and M2 functions have tended to show considerably less correlation over the 1974-87 period, suggesting that M2 has become a more useful complement for policy purposes during this period of difficulty in interpreting the behavior of M1. Finally, when estimated over 10-year periods, the coefficients in the money demand functions for M1 and M2 have varied over fairly wide ranges, raising some questions about our ability to use estimates of these elasticities to forecast money growth out of sample.

John Wenninger

Monetary Policy and Open Market Operations during 1987

Monetary policy in 1987 sought to sustain moderate economic growth against a backdrop that often included heightened concerns about inflation, stimulated in part by sharp declines in the dollar in foreign exchange markets, and considerable volatility in equity and bond markets, dramatized by the unprecedented decline in stock prices in October. The movements in the dollar reflected disappointment that the U.S. trade deficit was not yet declining in nominal terms despite the earlier weakening of the dollar, and limited success in adjusting fiscal policy in the U.S. and economic policies abroad to restore better balance to the world economy. Reserve pressures were increased somewhat between April and September from their minimal 1986 levels to counter inflationary developments, while also helping to stabilize the dollar in the foreign exchange markets. In addition, in early September, the discount rate was raised by one-half percentage point to 6 percent.

The policy climate was dramatically altered by the steep decline in stock prices on October 19. There was unusual uncertainty about the implications for future

economic activity, and financial market volatility intensified. The desire for safety and liquidity supported the Treasury market, but normal position financing was disrupted by concerns over the financial condition of securities houses and others seeking to borrow. In the weeks that followed, the Desk responded by reducing the degree of reserve pressure noticeably and providing reserves flexibly, consistent with Chairman Greenspan's pledge that the Federal Reserve would ensure adequate liquidity in the markets in the unsettled environment. Greater weight than usual was given to money market conditions to help facilitate the return to a more normal functioning of financial markets. Growth in nonborrowed reserves surged in late October as open market operations accommodated a large increase in required reserves associated with a sharp rise in transactions deposits, substantially enlarged desires for excess reserves, and an increased reluctance to use the discount window. By late December, policy implementation began to work back towards a more normal approach to reserve provisions oriented toward achieving the reserve objectives. However, reserve management remained sensitive to a lingering reluctance to borrow and the fragile conditions in the financial markets.

Growth of the monetary aggregates decelerated in 1987 from the rapid rates of 1986, in part reflecting higher market interest rates. The higher interest rates helped income velocity of the monetary aggregates to rise after declining in recent years. From 1986-IV to 1987-IV, M2 and M3 expanded 4.1 and 5.4 percent, respectively, placing M2 substantially below, and M3 close to the bottom of, their corresponding growth ranges established by the FOMC, while M1 expanded

Adapted from a report submitted to the Federal Open Market Committee by Peter D. Sternlight, Executive Vice President of the Bank and Manager for Domestic Operations of the System Open Market Account. Sandra Krieger, Chief, Open Market Analysis Division, was primarily responsible for preparation of this report, working under the guidance of Ann-Marie Meulendyke, Manager, Open Market Operations Department. Jeremy Gluck, an economist in the Open Market Analysis Division, also contributed to the writing of the report. Other members of the Open Market Analysis Division assisting in the preparation were Robert Van Wicklen, Jack Krafcheck, Debra Chrapaty and Martin Gonzalez. Peter Rappoport, an economist from the Domestic Research Department, also assisted in the production of the report.

5.9 percent.¹ The slower growth of the broader aggregates was viewed as acceptable, given the course of economic activity, inflation, and exchange rates. Growth of real GNP picked up to 4.0 percent on a fourth quarter over fourth quarter basis, extending the latest economic expansion into its fifth year. The rate of inflation accelerated relative to 1986, although it showed some moderation over the second half of the year. Measured from year-end to year-end, the trade-weighted value of the dollar fell about 18 percent over 1987.

Concerns over the outlook for inflation and for the demand for dollar-denominated assets lifted yields, on balance, in 1987. Yields on most fixed-income securities rose between late March and mid-October with only a temporary respite midway through the year, while they reversed course following the steep drop in equity prices. Inflation apprehensions heightened in late March and again in late summer in the face of rising levels of resource utilization and sharp declines in the dollar. Increases in prices of oil and other commodities contributed to the inflation concerns. There were also worries about protectionist measures, brought to the surface in March by the announcement of certain U.S. trade sanctions against Japan. Yields continued to rise after the Federal Reserve's firming actions in September as market participants appeared to anticipate further domestic monetary tightening in an environment of firmer policies abroad and pessimistic outlooks for the dollar and inflation.

Yields on investment-grade securities fell precipitously after the mid-October drop in equity prices. Although the markets were quite volatile for a time, overall, yields held much of their declines through year-end as most participants revised down their outlooks for economic growth and inflation. Rate cuts abroad also helped to reduce tensions in the financial markets. While Congress' struggles to bring down future budget deficits also were viewed positively, additional rate declines were tempered by the limited results of its efforts. The dollar

came under renewed downward pressure in late December, setting new lows by year-end, but upward pressure on yields was checked by the uncertain prospects for economic growth in 1988 and the growing belief that in such circumstances the Federal Reserve would not respond to the dollar weakness by raising interest rates.

Some special factors affected the technical implementation of policy during the year. Reserve management was complicated by wide and uncertain swings in the Treasury's balance at the Federal Reserve. An unprecedented increase in April tax payments and heightened uncertainty over corporate tax flows at other times during the year contributed to the volatility and uncertainty surrounding Treasury cash balances; tax flow patterns were distorted by adjustments to the Tax Reform Act of 1986. Congress' delay in taking action to raise the debt ceiling also complicated reserve management, as the Desk had to respond to the indeterminate scheduling of postponed auctions and take account of the reserve effects of security paydowns.

The monetary aggregates

Growth of the monetary aggregates slowed markedly in 1987. Demand for monetary assets and credit moderated as interest rates rose, rate incentives favored market instruments, and businesses and consumers adjusted to the new tax laws. The slower growth was associated with a strengthening of velocity and was acceptable to the Committee in view of the continuing expansion in business activity and concerns about potential inflationary pressures. Over the four quarters of the year, M2 and M3 grew 4.1 and 5.4 percent, respectively, while M1 grew 5.9 percent (Chart 1). The debt aggregate grew 9.6 percent. The income velocities of M2 and M3, after declining by 4.1 percent in 1986, grew 3.2 and 1.9 percent, respectively, while M1 velocity grew 1.4 percent (Chart 2). The rate of decline of the velocity of the debt aggregate moderated relative to 1985 and 1986 to 2.0 percent.

Monetary policy in 1987 was guided by the desire to foster monetary growth consistent with continued progress over time in reducing the underlying rate of inflation while supporting orderly economic growth and contributing to an improved pattern of international transactions. In line with these objectives, in the February evaluation of the 1987 monetary growth ranges that were set tentatively the preceding July, the FOMC affirmed the one-half percentage point reduction from the previous year's growth ranges for M2 and M3, to 5½ to 8½ percent, measured from 1986-IV to 1987-IV. The actual outcome was expected initially to be close to the middle of the ranges and near the anticipated growth in nominal income, assuming reasonably stable

¹All money growth rates cited in this report are based on the data available before the benchmark and seasonal revisions in February 1988. The earlier data were used because they represent the information available to the FOMC members at the time that their decisions were being made. Over the four quarters of 1987, the revisions raised the growth rate of M1 by 0.3 percentage point to 6.2 percent, lowered the growth rate of M2 by 0.1 percentage point to 4.0 percent, and left the growth rate of M3 at 5.4 percent. The relatively large revision to M1 primarily reflected redefinitions to make the treatment of thrift institutions identical with that of commercial banks in the construction of the monetary aggregates. Under the new definitions, all vault cash at thrifts and thrift transactions deposits held at banks are excluded from M1. The redefinitions had no effect on levels of M2 and M3.

The intra-yearly growth patterns of the aggregates were modified slightly by the revisions. When the revised data were used, quarterly M1 growth was weaker in the first quarter and stronger thereafter, while quarterly growth rates of M2 and M3 were stronger in the first half of the year and weaker in the second.

Chart 1A

M2: Levels and Target Ranges

Cones and Tunnels

Billions of dollars

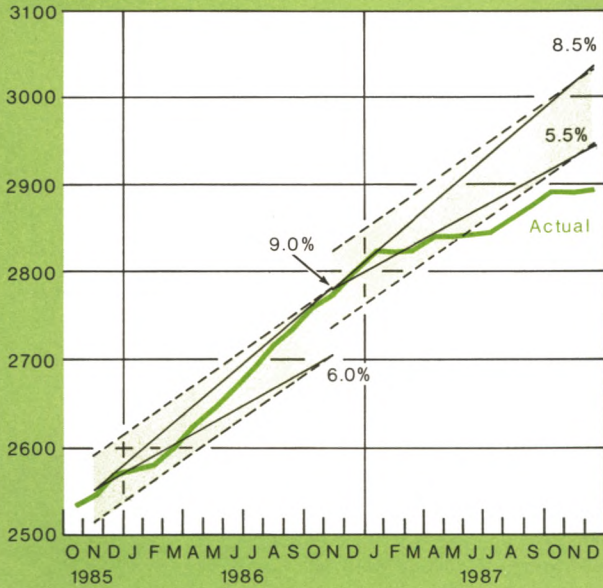


Chart 1B

M3: Levels and Target Ranges

Cones and Tunnels

Billions of dollars

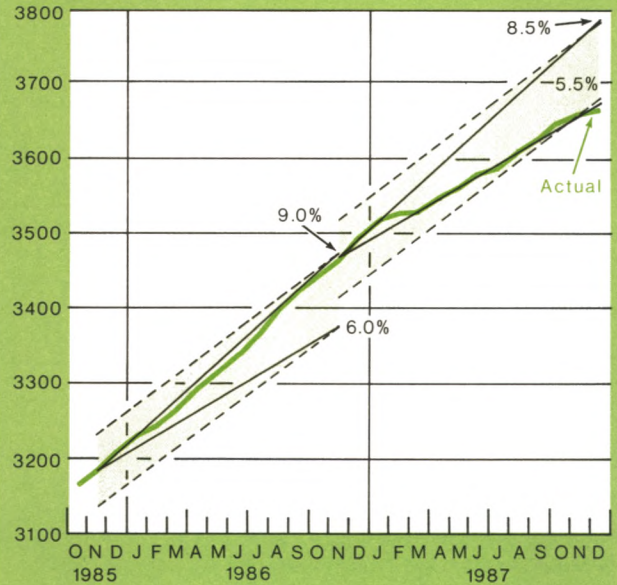


Chart 1C

Total Domestic Nonfinancial Debt Levels and Monitoring Ranges

Cones and Tunnels

Billions of dollars

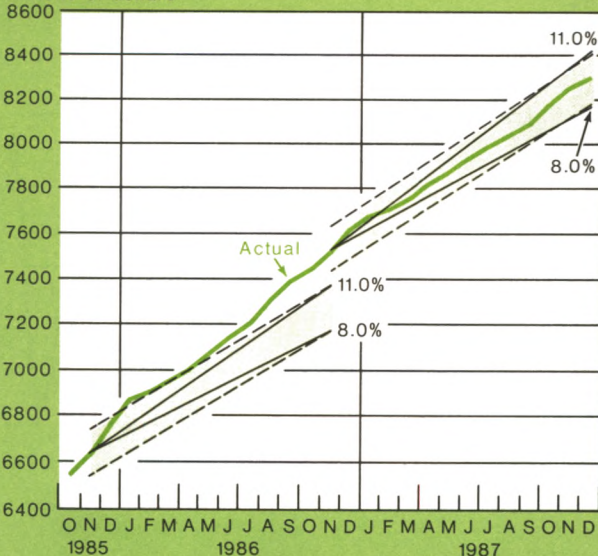


Chart 1D

M1 Levels

Cones and Tunnels

Billions of dollars

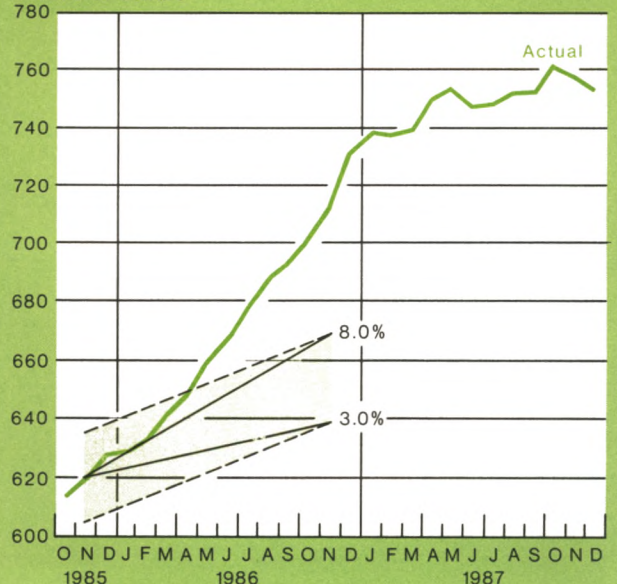
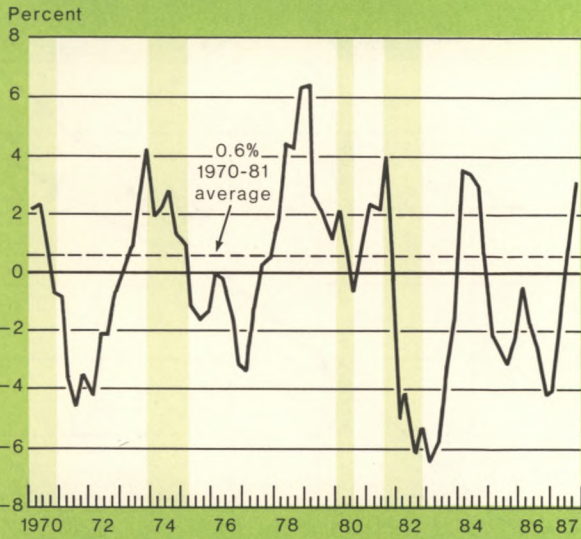


Chart 2A

M2 Velocity Growth *

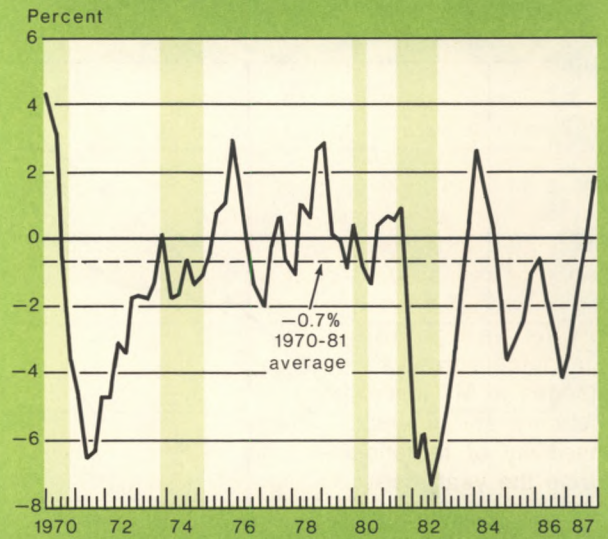


*Growth from four quarters earlier.

Shaded areas represent periods of recession as defined by the National Bureau of Economic Research.

Chart 2B

M3 Velocity Growth *

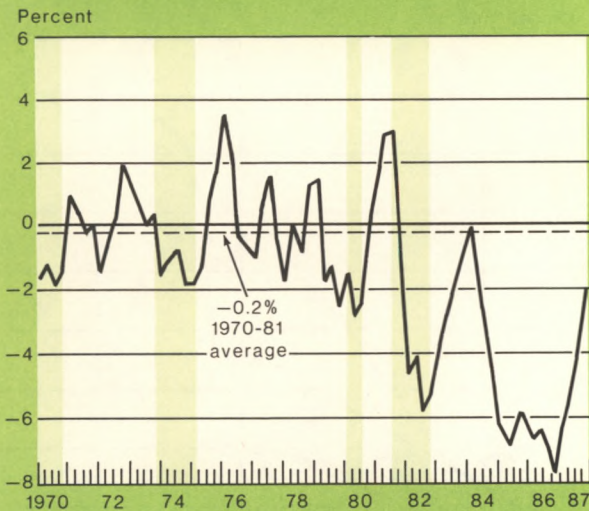


*Growth from four quarters earlier.

Shaded areas represent periods of recession as defined by the National Bureau of Economic Research.

Chart 2C

Total Domestic Nonfinancial Debt Velocity Growth *

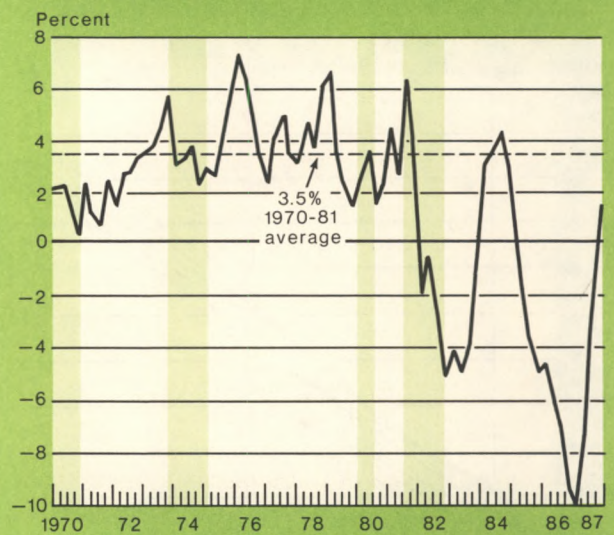


*Growth from four quarters earlier.

Shaded areas represent periods of recession as defined by the National Bureau of Economic Research.

Chart 2D

M1 Velocity Growth *



*Growth from four quarters earlier.

Shaded areas represent periods of recession as defined by the National Bureau of Economic Research.

interest rates. The Committee continued to monitor the growth of total domestic nonfinancial debt and reaffirmed the range of 8 to 11 percent for 1987 set tentatively the previous July. It noted that growth of total debt was likely to moderate considerably in 1987 while remaining in excess of the expansion in nominal GNP.

The FOMC anticipated that M1 growth would slow in 1987 from its very rapid pace in 1986 but elected not to establish a numerical range for it, given the earlier unpredictability of M1 behavior relative to economic activity. This development reflected the aggregate's heightened sensitivity to interest rates since the deregulation of deposit rates and the related increase in the use of interest-bearing components of M1 as a repository for savings as well as transactions funds. The Committee agreed to evaluate the appropriateness of changes in M1 in the context of developments in the economy and financial markets. It also foresaw the possibility of targeting M1 growth from time to time during the year, depending on the circumstances prevailing then, including the behavior of the broader monetary aggregates.

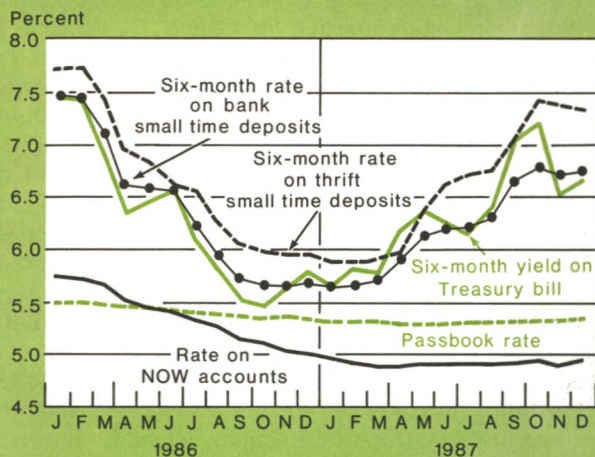
As anticipated, growth of the monetary aggregates slowed over the first half of the year, partly reflecting an unwinding of the late 1986 buildup in transactions deposits and bank credit that had been prompted by incentives to complete certain types of transactions before the new tax law took effect in January 1987. The reduced demand for household-type M2 assets may also have reflected adjustment to changes in the tax treatment of interest on installment credit to the extent that it encouraged individuals to pay down most types of consumer debt and to finance expenditures out of liquid assets rather than with credit. The moderation in monetary growth also reflected the lagged response of bank deposit rates to the upward movements in market rates that began in April. Growth of M3 was affected additionally by banks' increased reliance on funding sources outside of this aggregate, such as foreign branch deposits and balances in the accounts held for the Treasury.

During May, deposits within M2 began to shift towards longer term retail accounts as rates on time deposits adjusted more promptly to rising market rates than did returns on more liquid instruments (Chart 3). Small time deposits began to build up, after having declined for about a year in a climate of generally falling rates. Inflows to small time deposits were strongest at thrift institutions, reflecting relatively more attractive offering rates and, in some cases, aggressive bidding from institutions encountering difficulties in issuing large uninsured time deposits. Meanwhile, growth in savings deposits slowed, while money market deposit accounts continued to post declines as had been their pattern

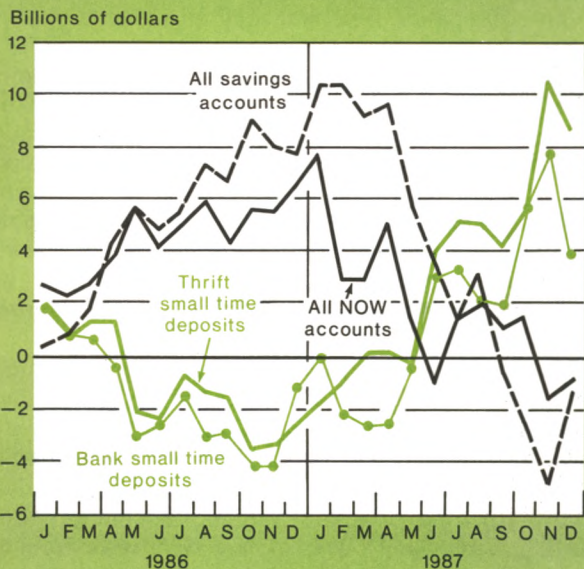
since February.

Growth in transactions deposits slowed over the first part of the year to a pace not seen since 1984, the last time interest rates had risen on a sustained basis. Between January and March, demand deposits reversed their extraordinary rise of late 1986 while inflows to other checkable deposits moderated. In April, a surge in M1 deposits appeared to reflect a buildup of checking balances by individuals to pay tax liabilities that were

Chart 3
Consumer Deposit Rates versus Treasury Bill Rates



Changes in Selected Consumer Deposits



enlarged by the extra capital gains realized in late 1986. Once tax payments were completed, M1 growth slowed again, reflecting the increases in money market rates that raised the opportunity cost of holding checkable deposits and reduced business' compensating balance requirements. From 1986-IV through June, M1 grew at a 7.6 percent annual rate and the rate of decline of its income velocity slowed compared to 1985 and 1986.

By June, M2 was below, and M3 about at the bottom of, the Committee's annual growth ranges. Over the first half of the year, growth in M2 and M3 fell short of the expansion of nominal GNP, and their velocities consequently rose (1987-II over 1986-IV) after having declined sharply in 1986. Growth of the debt aggregate, which was within its monitoring range, outpaced that of GNP but was more moderate than in 1986.

When monetary behavior was reviewed at midyear, the Committee did not change the annual growth ranges for 1987. It noted that growth in the broader aggregates around the lower ends of their annual ranges might be appropriate, and even slower growth in M2 might be acceptable, depending on developments with respect to velocity and inflation and provided that economic activity was expanding at an acceptable pace. With regard to M1, the Committee decided not to set a specific target range for the second half of the year. It noted the aggregate's continued sensitivity to changes in interest rates, illustrated by its sharp deceleration in the first half of the year, and the still limited experience with the behavior of deregulated transactions accounts. However, it agreed to take account of M1 growth, in the context of prevailing circumstances, in reaching operational decisions over the balance of the year.

The aggregates grew modestly on balance over the second half of the year. In August, the decline in demand deposits moderated, while inflows to other checkable deposits increased. M2 was lifted relative to M1 by strength in overnight repurchase agreements (RPs) at banks and renewed growth in noninstitutional money funds, with the latter continuing into September. Banks increased their overnight RP commitments sharply in August in line with growth in their acquisition of Treasury securities for trading accounts. M3 was supported by stronger M2 as well as by faster growth in term Eurodollars in August and September.

Growth of the aggregates was boosted again in October as the drop in stock prices prompted moves to short-term liquid assets. Demand deposits surged in association with the huge increase in financial transactions that accompanied the turmoil in the markets. Inflows to time deposits and money market funds swelled, presumably with money withdrawn from the stock market. Meanwhile, MMDAs and savings deposits declined further.

As market conditions steadied over the remainder of the year, weakness in the underlying demand for most types of deposits and credit became apparent again. Checkable deposits more than reversed their October increase, and M1 declined in November and December. M2 ended the year substantially below its annual range, while M3 was about at the bottom of its range. Domestic debt remained within its monitoring range.

The economy and financial markets

The economy

Growth in economic activity accelerated in 1987, the fifth year of one of the longest expansions in U.S. history. Real growth was better balanced across sectors than in 1985 and 1986, with agriculture, mining, and manufacturing benefiting from improvements in their competitive positions in overseas markets. From 1986-IV to 1987-IV, real GNP increased by 4.0 percent, compared to 2.2 percent in 1986. Business inventory investment surged, after having declined somewhat in 1986, and accounted for almost half of the increase in total output. By contrast, final sales slowed dramatically after having outpaced the increase in total output a year earlier. Overall growth was fairly evenly distributed across the four quarters of the year, in contrast to 1986 when growth spurted in the first quarter and was quite modest thereafter.

Final sales added 2.0 percentage points to real GNP over the four quarters of 1987, compared with 2.6 percentage points a year earlier. Over the four quarters of the year, consumption rose by a modest 1.0 percent compared with a 4.1 percent gain in 1986, reflecting in part smaller increases in real disposable income. Consumer spending pulled back somewhat in the first quarter after a strong showing in 1986, ahead of changes in 1987 tax laws that ended sales tax deductions for income tax purposes in addition to limiting tax deductions for installment credit interest. A renewed retrenchment was apparent as the fourth quarter of the year began but likely was deepened by the subsequent scaling back of some auto sales incentives and the decline in the stock market.

Net exports and nonresidential fixed investment increased over the four quarters of 1987, after having declined in 1986. Export growth picked up strongly through another year of dollar depreciation. On an annual average basis, the growth of total imports slowed, reflecting a decline in the first quarter and relatively moderate growth thereafter. Government purchases in 1987 increased by less than in 1986, although they rose sharply in the fourth quarter, boosted by year-end placement of crops with the Commodity Credit Corporation.

Employment on a fourth quarter over fourth quarter

basis increased 2.8 percent in 1987, moderately more than in 1986, and grew substantially faster than the civilian labor force. Manufacturing employment showed strong gains in the second half of the year, following modest increases beginning in late 1986 and declines between about mid-1984 and mid-1986. The civilian unemployment rate declined from 6.8 percent in the fourth quarter of 1986 to 5.9 percent in the final quarter of 1987. Despite the tightening labor market, wage pressures remained subdued, with nonfarm business compensation per hour increasing only by 2.8 percent, less than the 3.4 percent increase the previous year. Meanwhile, nonfarm business output per hour grew by 1.2 percent, somewhat less than in 1986.

The rate of price increase in 1987 exceeded that in 1986, but after a sharp rise in the first quarter, inflation moderated. Over the four quarters of 1987, the implicit GNP deflator rose 3.3 percent compared with an increase of 2.2 percent in the previous year. The consumer price index rose by a more substantial 4.4 percent, well above the 1.3 percent pace of 1986, when it had been held down by declining energy prices.

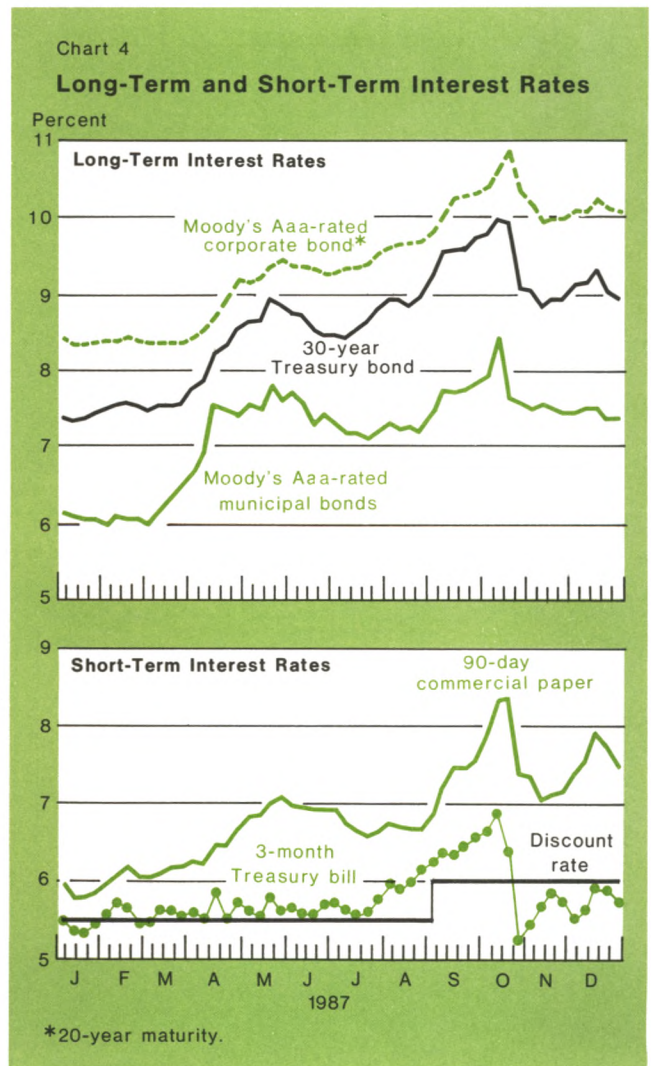
The 1987 fiscal year Federal budget deficit declined to \$150 billion from \$221 billion in 1986. However, slightly more than half of the decline came from one-time effects, including transitional aspects of tax reform and asset sales. Stronger growth in the economy increased income-related revenues in fiscal year 1987 while declines in interest rates and restrained cost-of-living adjustments helped to control the increase in outlays.

Measured in current dollars, the merchandise trade deficit increased by \$11 billion to \$154 billion in 1987, but in real terms it diminished for the first time since 1980, from \$176 billion in 1986 to \$163 billion in 1987.² The trade-weighted value of the U.S. dollar declined by about 18 percent from year-end 1986 to year-end 1987, despite substantial official intervention to support the dollar and some widening of the spread of U.S. real long-term interest rates over comparable rates of other major industrialized countries.

Domestic financial markets

Long-term interest rates rose markedly during 1987, while short-term rates increased less dramatically (Chart 4). The increase in long-term rates was concentrated in two periods. From late March to mid-May, Treasury coupon yields rose by roughly 150 basis points. After declining by about 65 basis points through late June, these yields climbed around 180 basis points until the October 19 stock market crash, when they dropped precipitously. Over the year, long-term Treasury coupon yields increased by about 145 basis points.

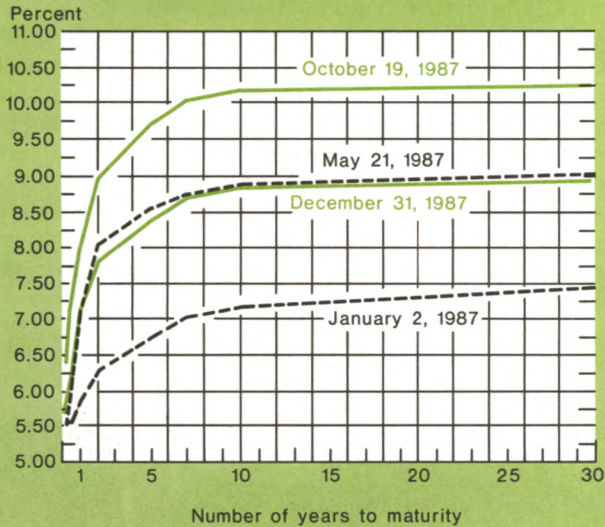
Short-term rates also rose during 1987 but by somewhat less than long-term rates. As a consequence, the yield curve steepened, particularly in the one- to three-year maturity range (Chart 5). Through the first half of the year, short-term Treasury bill rates generally fluctuated in a narrow band somewhat above the 5.5 percent discount rate. Over that time, these rates were held down by the relative scarcity of bills, a product of net paydowns at most of the Treasury's weekly bill auctions. Intervention-related demand for bills by foreign central banks also provided periodic support. Rate movements of most other short-term market instruments followed the general climb of longer term rates between late March and mid-May. By late July, short-term Treasury bill rates also began to rise, and increased roughly 165 to 200 basis points by mid-October. In the abnormal conditions



²Source: National Income and Product Accounts.

Chart 5

Yield Curves for Selected U.S. Treasury Securities

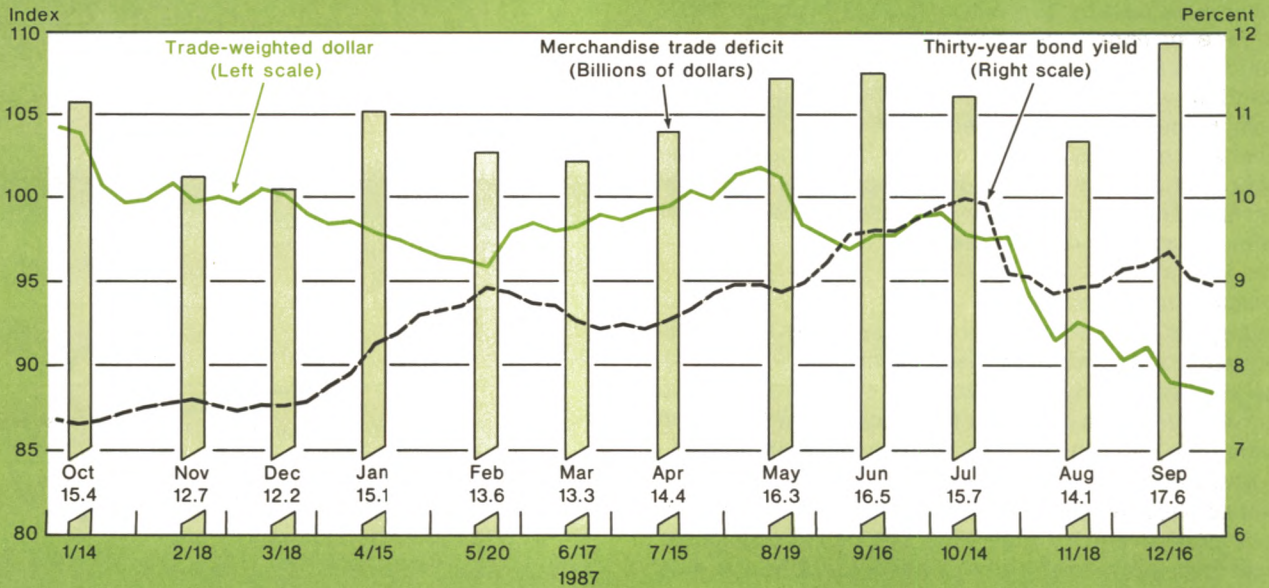


following the stock market crash, the three-month bill rate plunged, briefly approaching its October 1986 low of around 5 percent, while other short-term rates fell less sharply. For the year as a whole, three-month bill rates were up about 35 basis points, excluding year-end pressures. Other short-term rates rose a net 70 to 110 basis points over the year.

The enduring influence on U.S. securities markets through most of 1987 was the condition of the dollar in the foreign exchange markets. The dollar dropped to new lows of 121 Japanese yen and 1.57 deutsche marks on December 31, with most of the decline occurring in the last four months of the year (Chart 6). The fall in the dollar frequently engendered fears among market participants of rising inflation, possible Federal Reserve tightening, and diminished foreign demand for dollar-denominated assets. As the year progressed, the view solidified that adjustments of external imbalances in the context of acceptable overall performance of domestic economies would require international policy coordination, including a concerted effort to cut future U.S. government deficits. In this environment, the monthly announcements of the U.S. merchandise trade deficit and the extent of cooperation among G-7 governments and central banks were watched closely by

Chart 6

Merchandise Trade Deficit, the Trade-weighted Value of the Dollar and the Thirty-Year Treasury Bond Yield*



* Merchandise trade deficits recorded in period when they were announced.

financial market participants.³ Disappointing news on both these fronts preceded the massive October sell-off on world stock exchanges.

Yields on Treasury securities showed modest net changes through late March. Rates responded favorably to Chairman Volcker's February "Humphrey-Hawkins" testimony, which affirmed that the FOMC had not tightened its policy, and to the steadying of the dollar following the Louvre Accord in February, which was aimed at stabilizing exchange rates among six of the G-7 nations. However, activity in the fixed-income markets was lethargic over the first few months of the year, and attention turned to other markets, such as those for equities and mortgage-backed securities.

The inertia in the markets broke in late March when the dollar weakened sharply. The falling dollar, combined with data suggesting higher inflation and rising commodities prices, caused Treasury coupon yields to climb through mid-May. Yields on municipal and mortgage-backed securities experienced sharp volatility at times, the latter reflecting changing assumptions about prepayments and duration. Worries about protectionist measures, heightened by the U.S. imposition of limited trade sanctions on Japan in late March, also weighed on market sentiment. Statements by U.S. and Japanese officials that the dollar had fallen sufficiently and Chairman Volcker's acknowledgment of a "slight snugging" were outweighed by the perception that only fundamental fiscal and monetary policy changes could prevent further dollar depreciation. Nevertheless, by the end of June, against the background of the System's firming actions, complementary actions abroad, and evidence of improvement in the merchandise trade deficit, the dollar had stabilized somewhat and coupon yields had eased, benefiting not only from the dollar development but also from more favorable inflation data.

The sharp run-up of yields from mid-July until the stock market crash seemed to be the product of heightened inflationary concerns and perceptions of tightening monetary policies in the United States and abroad. These perceptions were fostered by high May and June trade deficits, stronger economic data, and rising yields in Japan, Germany, and Great Britain. The bond market seemed to pay little attention to the notable improvement in the dollar that continued through mid-August, but the subsequent weakening of the dollar contributed to rising yields. In the bearish atmosphere for fixed-income securities, investor interest was increasingly attracted to the stock market where prices had been rallying since June. Interest rates continued to rise after the 50 basis-point increase in the discount rate on September 4, which apparently failed to counter

³The G-7 (Group of Seven) nations are Canada, France, Italy, Japan, the United Kingdom, the United States, and West Germany.

the widespread view that the dollar was likely to fall further. Interest rate increases overseas contributed to the pessimistic outlook for the dollar.

Against this backdrop of rising world interest rates and the high level of stock prices in relation to earnings, the more immediate catalysts of the sharp stock market sell-off were evidently the release of the disappointing August trade deficit data and the perception of a breakdown of international economic cooperation. Following the stock market break, yields on Treasury securities dropped dramatically in the ensuing "flight-to-quality." Even after the initial flight, Treasury issues continued to rally in anticipation of weaker economic growth, more accommodative monetary policies in the United States and abroad, and improved international policy coordination. The declines were most noticeable for short-term bills. In the nine days following October 19, three-month bill rates plunged as much as 200 basis points from mid-October highs. However, as the crisis atmosphere abated, bill rates and coupon yields backed up somewhat and the yield curve flattened.

Yields continued to be buffeted over the balance of the year, although the extreme nervousness in the financial markets gradually subsided. Yields backed up when Congress experienced difficulty in reaching its bipartisan agreement to lower budget deficits. Yields also rose in response to strong November employment data, a huge October trade deficit, and weakness in the dollar, but eased towards year-end amid a growing market belief that the Federal Reserve would not tighten in order to support the dollar in the face of uncertain economic prospects.

Some federally sponsored agencies experienced solvency-related problems during 1987. Early in the year, the Federal Farm Credit Banks System (FFCB) reported a \$1.9 billion loss for 1986 and the prospect of \$4.7 billion of additional losses for 1987-90, contributing to the widening of yield spreads of FFCB debt over comparable Treasury securities during the first half of the year. The FFCB first requested assistance from Congress in March, and by August, a bailout package appeared likely, causing spreads over Treasuries to decline somewhat. The insolvency of the Federal Land Bank of Jackson, Mississippi, in December was followed by Congressional approval of a rescue package at year-end. The bill authorizes the Farm Credit System (FCS) to issue \$4 billion of 15-year bonds, of which \$2.8 billion may be offered in 1988. The Treasury will share the interest burden, though the FCS is expected to reimburse the Treasury once the FCS regains its health.⁴

⁴The bill also authorized the creation of the Federal Agricultural Mortgage Corporation, which will underwrite secondary market sales of packages of small rural mortgages and loans by banks, thrifts, and insurance companies. The Corporation was given a \$1.5 billion line of credit with the Treasury.

Congress and the Administration also approved a recapitalization plan for the Federal Savings and Loan Insurance Corporation (FSLIC) in August. FSLIC had ended 1986 technically insolvent. Under the plan, a new subsidiary of the Federal Home Loan Bank Board (FHLBB), the Financing Corporation (FICO), was authorized to issue up to \$10.8 billion of debt over three years to recapitalize FSLIC but no more than \$3.75 billion per year. (The FHLBB oversees FSLIC.) Principal payments on FICO issues are backed by zero-coupon Treasury bonds, and interest payments are secured by a first lien on insurance premia paid to FSLIC. Between September and year-end, FICO sold \$1.2 billion of 30-year bonds at spreads of about 90 basis points over comparable Treasury securities.

Corporate bonds

Public offerings of domestic corporate bonds fell somewhat in 1987 to around \$210 billion. Although issuance began the year at a pace even higher than the record set in 1986, it slackened in April as interest rates began to rise. Issuance fell off most noticeably in long-term securities; while corporations pulled back as rates rose, investor interest also waned amid considerable uncertainty about the outlook for interest rates. As rates rose above 1986 levels, the volume of refinancings dropped; however, refinancing picked up after the post stock crash decline in rates, pulling the ratio of net to total issuance including private placements below the 1986 ratio. The spreads between yields on high-grade corporate securities and Treasury bonds narrowed with the light issuance in the spring but widened briefly in the fall as Treasuries benefited more from the flight from stocks; the spreads ended the year with small net changes.

"Junk bonds," or bonds issued in the below investment-grade category, accounted for roughly 30 percent of new issuance of rated bonds during 1987, according to Moody's Investors Service. They continued to attract investors through much of the year, in spite of ongoing investigations by the Securities and Exchange Commission and the U.S. Attorney General's office into insider-trading related issues, including some inquiries that were perceived as having possibly adverse implications for a leading underwriter of junk bonds. However, unlike other fixed-income securities, junk bonds were adversely affected by the stock market collapse, and spreads to Treasuries widened by 150 basis points or more during the last days of October. Newly offered leveraged buyout issues were particularly hard hit, since their success was predicated on raising cash from asset sales to cover their obligations. Spreads of junk bond issues over Treasuries

narrowed toward year-end after the supply of new issues all but dried up.

Bank earnings, and in some cases ratings on bank paper, were hurt by problem loans to LDCs. Soon after Brazil suspended interest payments in March, two major banks transferred their Brazilian loans to nonaccrual status. During the second quarter, a number of banks took the additional step of increasing their loan loss reserves, with the money center banks reclassifying roughly \$12 billion of loans, equivalent to about 25 percent of outstanding LDC exposure. A few large regional banks boosted their loan loss reserves further to about 50 percent of LDC exposure during the fourth quarter, but most money center banks, with substantially higher LDC exposure, did not follow suit. The strain on balance sheets from loans to LDCs led rating agencies to downgrade the paper of several banks during the year. Generally, the moves did not surprise financial market participants and had limited impact on the banks' funding ability. The increased provisioning for loan losses in the second quarter tended to lift bank stock prices. Over the year, however, stock prices of most money center banks were significantly lower, showing greater weakness than the Dow-Jones Industrial Average and Standard and Poor's 500 stock index.

Municipal bonds

The municipal bond market experienced turbulent times in 1987. The effects of past tax legislation were felt as the volume of new issues declined and banks ceased to be major purchasers of municipal bonds. Several underwriters withdrew from the market, citing falling profits as the cause. Late in the year, the market was disturbed further by a Congressional proposal to tax unrealized capital gains on bonds sold at a discount, although it recovered when the legislation was dropped. The unsettled condition of the market reduced liquidity and caused a marked increase in the volatility of yields. Although yield spreads of Treasury issues over tax-exempt issues widened over the year as a whole, they were dramatically negative relative to revenue bonds in April, apparently because a number of individual investors sold tax-exempt issues to raise cash for income tax payments and equity investments.

Market sources report that municipal issuance fell for the second year in succession, from around \$145 billion in 1986 to about \$100 billion. Part of the decline may have been the consequence of heavy issuance in advance of tax legislation taking effect in 1986, but there was also a drop in refunding issues in 1987 as interest rates rose. Refunding volume fell from roughly \$55 billion in 1986 to approximately \$40 billion in 1987. Over half of the 1987 refundings occurred in the first quarter of the year, prior to the jump in yields in April and May.

The new tax laws also resulted in changes in ownership of municipal bonds. Commercial banks were less active buyers of municipal bonds after the Tax Reform Act of 1986 eliminated the deductibility of carrying costs. Their share of outstanding municipal issues fell to 25 percent in 1987-IV from about 30 percent in 1986-IV. Individuals' share of municipal holdings (including mutual funds) rose to 49 percent in 1987-IV from about 43 percent in 1986-IV. Also, insurance companies re-emerged as major buyers.

Policy implementation

The thrust of the FOMC's policy remained essentially unchanged from late 1986 through March 1987. (Notes on the FOMC directives and the assumptions used in constructing the reserve paths are in Table 1.) Beginning in April, in light of downward pressure on the dollar in the foreign exchange markets and heightened concerns about inflation, the Desk exercised increasing caution in providing reserves. Open market operations were adjusted to impose a somewhat greater, but still limited,

Table 1

Specifications from Directives of the Federal Open Market Committee and Related Information

Date of Meeting	Short-Term Annualized Rate of Growth Specified for Period Indicated		Borrowing Assumption for Deriving Nonborrowed Reserve Path (Millions of Dollars)	Discount Rate (Percent)	Notes
	M2	M3			
2/10 to 2/11/87	January to March 6 to 7 6 to 7 Growth in M1 was expected to slow substantially from the high rate of earlier months.		300	5 1/2	The Committee sought to maintain the existing degree of pressure on reserve positions. Somewhat greater reserve restraint would, or slightly lesser reserve restraint might, be acceptable depending on the behavior of the aggregates, taking into account the strength of business expansion, developments in foreign exchange markets, progress against inflation, and conditions in domestic and international credit markets.
3/31/87	March to June 6 or less 6 or less Growth in M1 was expected to remain substantially below its pace in 1986.		300 400 on April 30	5 1/2	The Committee agreed to maintain the existing degree of pressure on reserve positions. Somewhat greater reserve restraint might be acceptable depending on developments in foreign exchange markets, taking into account the behavior of the aggregates, the strength of business expansion, progress against inflation, and conditions in credit markets.
5/19/87	March to June 6 or less 6 or less Growth in M1 was expected to remain well below its pace in 1986.		400 500 on May 21	5 1/2	The Committee sought to increase somewhat the degree of reserve pressure from that sought in recent weeks, taking into account the possibility of a change in the discount rate. Somewhat greater reserve restraint would, or somewhat lesser reserve restraint might, be acceptable depending on indications of inflationary pressures and on developments in foreign exchange markets as well as the behavior of the aggregates and the strength of business expansion.
7/7 to 7/8/87	June to September 5 to 7 1/2 5 to 7 1/2 Growth in M1, while picking up from recent levels, was expected to remain well below its pace in 1986.		500	5 1/2	The Committee sought to maintain the existing degree of pressure on reserve positions. Somewhat greater/lesser reserve restraint would be acceptable depending on indications of inflationary pressures and on developments in foreign exchange markets, as well as the behavior of the aggregates and the strength of the business expansion.

Table 1

Specifications from Directives of the Federal Open Market Committee and Related Information (continued)

8/18/87	June to September 5 5	500 600 on Sept. 3	5½ 6 on Sept. 4-11	The Committee sought to maintain the existing degree of pressure on reserve positions. Somewhat greater reserve restraint would, or slightly lesser reserve restraint might, be acceptable depending on indications of inflationary pressures, the strength of the business expansion, developments in foreign exchange markets, as well as the behavior of the aggregates.
9/22/87	August to December 4 6	600 500 on Oct. 23 450 on Oct. 28	6	The Committee sought to maintain the slightly firmer degree of pressure on reserve positions that had been sought in recent weeks. Somewhat greater/lesser reserve restraint would be acceptable depending on the indications of inflationary pressures, the strength of the business expansion, developments in foreign exchange markets, as well as the behavior of the aggregates.
11/3/87	September to December 6 to 7 6 to 7	450 400 on Nov. 4 300 on Dec. 4	6	The Committee sought to maintain the degree of pressure on reserve positions that had been sought in recent days. The Committee recognized that the volatile conditions in financial markets and uncertainties in the economic outlook might continue to call for a special degree of flexibility in open market operations, depending, in particular, on demands for liquidity growing out of recent or prospective developments in financial markets. Apart from such considerations, somewhat lesser reserve restraint would, or slightly greater reserve restraint might, be acceptable depending on the strength of business expansion, indications of inflationary pressures, developments in foreign exchange markets, as well as the behavior of the monetary aggregates.
12/15 to 12/16/87	November to March 5 6	300	6	The Committee sought to maintain the existing degree of pressure on reserve positions and to phase open market operations into a more normal approach to policy implementation keyed increasingly to a desired degree of reserve pressure while giving less emphasis than recently to money market conditions. The Committee recognized that still sensitive conditions in financial markets and uncertainties in the economic outlook may continue to call for a special degree of flexibility in open market operations. Taking account of conditions in financial markets, somewhat lesser or somewhat greater reserve restraint would be acceptable depending on the strength of the business expansion, indications of inflationary pressures, developments in foreign exchange markets, as well as the behavior of the monetary aggregates.

degree of pressure on reserve positions. These factors continued to be present during the summer, and the economic data were relatively strong. However, monetary growth was weak except for the brief spurt in April. In light of these factors, the same degree of pressure was maintained through August as the dollar firmed. By late August and early September, the dollar was again under attack in the foreign exchange markets, economic data continued to point towards moderate growth, and the growth of the monetary aggregates picked up in August. In light of these developments, which heightened the potential for greater inflation, the Desk further increased the degree of reserve pressure and, on September 4, the Board of Governors approved an increase in the discount rate from 5½ to 6 percent.

This gradual firming of reserve pressures was dramatically reversed after the October 19 plunge in stock prices worldwide. The Committee agreed on the need to assure adequate liquidity in order to facilitate the return to a more normal functioning of financial markets. Consistent with this policy, following the drop in stock prices, open market operations were directed toward an easing of reserve pressures and were conducted with special flexibility. Indeed, actual operations were guided by day-to-day developments since strict adherence to the earlier reserve targets would have resulted in a greater degree of money market pressure than the FOMC desired. As evidence of a reduced willingness to borrow from the discount window accumulated, the lesser demands for borrowing were accommodated through a relatively greater provision of nonborrowed reserves in order to keep money market conditions from firming. As market conditions settled down, the Desk sought by late December to work back toward a more normal approach to managing reserves but without seeking to restore the degree of restraint intended before the stock market break.

Through most of the year, the FOMC directed the Desk to implement policy in 1987 essentially as it has since early 1983. In carrying out the technique, the Desk targeted levels of nonborrowed reserves over two-week reserve maintenance periods that were believed to be consistent with achieving the degree of reserve pressure sought by the FOMC. The nonborrowed reserve target was derived in the following way: total reserves for each maintenance period were estimated as the sum of the demands for reserves to satisfy requirements and a cushion of excess reserves. The FOMC indicated the amount of discount window borrowing that it expected would be consistent with the desired level of reserve pressure. The assumed borrowing level was then subtracted from the total reserve estimate, leaving the nonborrowed reserve objective. Since banks' access to the discount window is restricted by amount and fre-

quency, forcing higher borrowing acts to increase reserve pressures. A lower intended borrowing level would translate into a more ample provision of nonborrowed reserves, tending to reduce money market pressures. The Desk assessed the need to add or drain nonborrowed reserves by comparing the objective with projections of the average supply of nonborrowed reserves in each maintenance period, which were prepared daily by staff members at the Federal Reserve Bank of New York and the Federal Reserve Board.

In its daily implementation of the nonborrowed reserve objectives, the Desk took account of both the expected duration and day-to-day pattern of reserve availability. In choosing between permanent and temporary reserve operations, it considered the projected reserve needs for the maintenance period in progress and the two subsequent periods. In general, if a sizable need to add (or, conversely, to drain) reserves was projected for a few consecutive maintenance periods, the Desk would typically opt to meet a portion of the need with outright purchases or sales of securities. Although these persistent needs to add or remove reserves have tended to follow a distinct seasonal pattern, that pattern was somewhat distorted in 1987 by the effects of the Tax Reform Act of 1986.

When the Desk added reserves by outright purchases of Treasury issues in 1987, it leaned much more heavily towards coupon issues than bills, reversing the pattern of recent years. On net, the Desk added \$17.4 billion of Treasury coupon issues and \$3.9 billion of bills to its portfolio and redeemed \$276 million of Federal agency issues. The shift toward coupon purchases was motivated by the relative scarcity of Treasury bills through much of the year, which reflected both Treasury bill paydowns and purchases by foreign official accounts. By year-end, the System's portfolio consisted of \$112.5 billion of bills, \$111.2 billion of coupon issues, and \$7.6 billion of Federally sponsored agency issues. The expansion in the System's outright holdings helped to meet reserve needs arising from an \$18 billion rise in currency in circulation, a \$2 billion decline in the Federal Reserve's holdings of foreign currency, and a \$2 billion increase in required reserves (all measured between the final maintenance period averages for 1986 and 1987), while increases in applied vault cash offset some of the reserve drains from other operating factors.

The distribution of reserve needs within each period was an important factor in determining the Desk's choice of days on which to enter the market and the duration of temporary operations to add or drain reserves. The Desk sought to avoid extraordinary reserve surpluses or deficiencies on individual days since both held the potential to induce unusual movements in the funds rate that could give misleading signals about the general

intent of policy. Moreover, a sizable daily reserve deficiency might leave the banking system with inadequate reserves for transactions clearing purposes and force undesirable spikes in discount window borrowing. The holding of these Federal Reserve clearing balances was motivated by the requirement that banks avoid overnight overdrafts and keep "daylight" overdrafts below levels specified by the Federal Reserve.⁵

In forming its reserve strategy, the Desk recognized the potential for revisions of the reserve projections. On the demand side, revisions of either estimated required reserves or the desired level of excess reserves could change the reserve outlook. On the supply side, revisions of estimated sources of nonborrowed reserves other than the Desk's open market operations—referred to as "operating factors"—held the same potential. Regardless of whether revisions originated on the demand or the supply side, those that occurred late in a maintenance period were most troublesome, as the Desk had relatively little remaining time over which to bring reserves in line with the objective. Achievement of the objective, in an effort to avoid sharp swings in borrowing or money market conditions, could necessitate very large reserve operations. Such large operations could be difficult to accomplish. Even if feasible, they could make reserves undesirably scarce or plentiful on the day.

Estimates of required reserves for each maintenance period were formed by applying a reserve ratio to the estimated level of transactions deposits. Since transactions deposits expanded at a somewhat slower-than-anticipated pace in 1987, there was a tendency to overestimate required reserves; on average, beginning-of-period and midperiod estimates ran about \$100 million above actual levels of required reserves. And while estimates on the final day on average were close to the actual levels, on occasion significant revisions of required reserve estimates occurred after a maintenance period ended. For example, a large *ex post* downward revision to required reserves in the September 9 maintenance period revealed that the Desk had overprovided reserves, partly accounting for the failure of borrowing to attain its new \$600 million target level. By contrast, notable underestimates of required reserves occurred in late April, reflecting the much larger-than-anticipated transactions balances that taxpayers built up in advance of payments and in late October, when liquid balances were particularly attractive in the wake of the stock market collapse. Overall, required reserves forecast accuracy in 1987 was slightly better than in 1986, with average absolute forecast errors of about \$390 million

at the beginning of the period and \$100 million on the final day. (Actual reserve data appear in Table 2.)

Excess reserve demand tended to run high when the distribution of reserves was skewed towards smaller institutions. These smaller banks and thrifts were generally less aggressive in their reserve management than larger institutions and often failed to run off accumulations of excess reserves. For example, excess reserves have shown a tendency to rise during periods in which social security payments are made—these payments are often disproportionately deposited at small banks. Excess reserves were also boosted in January and February when, following a typical pattern, small banks did not cut their reserve holdings enough to match the seasonal decline in required reserves or failed to employ the reserves created as currency returned from circulation after the year-end holidays. The Desk attempted to allow for these distributional effects, but the appropriate added allowance for excess reserves was subject to significant uncertainty.

In contrast, excess reserve demand ran lower during the final phase-in of reserve requirements on balances held at nonmember institutions under the Monetary Control Act of 1980. From September 1986 until September 1987, nonmember institutions needed to hold only 7/8 of the specified required reserves ratios against their deposits. The phase-up to 100 percent holding of required reserves raised the overall level of required reserves by an estimated \$1.7 billion. Following the pattern of recent years, some institutions did not fully adjust to the higher level of required reserves during the maintenance period in which the phase-in took place, causing excess reserves to run unusually low in that period. On balance, actual excess reserves deviated further from the beginning-of-period estimates in 1987 than they did in 1986.

On the supply side, the contribution of "operating factors" to nonborrowed reserves was particularly difficult to forecast in 1987. Much of this difficulty stemmed from uncertainty about the level of the Treasury's balance at the Federal Reserve—the average absolute period-to-period change in the Treasury balance was \$3.8 billion in 1987, more than double the 1986 figure. Not surprisingly, the absolute error in predicting this change on the first day of each maintenance period also rose, averaging \$885 million in 1987 as compared to \$510 million in 1986. However, if the exceptional April-May episode were excluded, the average error for 1987 would be reduced to \$565 million.

Other market factors also proved to be less predictable in 1987 than in 1986, but the differences were less dramatic. The mean absolute first-day error in estimating currency in circulation was \$290 million, compared to \$225 million in 1986, while the first-day errors in pre-

⁵For more detail on daylight overdrafts, see "Monetary Policy and Open Market Operations in 1986," this *Quarterly Review*, Spring 1987, pp. 35-56.

dicting float in 1987 and 1986 were \$310 million and \$225 million, respectively. Overall, the mean absolute first-day error in estimating the impact of all operating factors was about \$1,255 million in 1987, far above the \$510 million level of 1986. By the final day, this error had been reduced to about \$90 million, unchanged from 1986. Excluding the April-May period, the average absolute operating factor forecast error would be \$930 million, while the last-day error would be about \$80 million.

With revisions to the reserve outlook quite common over the typical maintenance period, and several periods in which the Desk had to add a substantial volume of reserves rapidly, the Desk relied relatively heavily on temporary reserve injections in 1987, particularly on System RPs. While customer-related and System RPs have the same reserve impact, the Desk has historically executed System, rather than customer-related, RPs when it has wanted to inject a relatively large quantity of reserves or to inject reserves for more than a single

business day; injections via customer-related RPs are constrained by the volume and the one-business-day horizon of foreign investment orders. Over the year, the Desk arranged \$395 billion of System RPs and passed through to the market \$155 billion of customer-related RPs. The Desk made limited use of matched sale-purchase agreements in the market to drain reserves, arranging a relatively small \$19 billion. The Desk preferred to avoid both adding and draining reserves within a maintenance period, although revisions to the reserve outlook or sharp turnarounds in reserve needs from one part of the period to another led the Desk to do so a few times in 1987.

As noted above, a major obstacle to policy implementation in 1987 was the difficult task of projecting the impact of the Treasury balance on reserve needs. In large part, the unusually high level of uncertainty surrounding the Treasury balance could be traced to two factors: the effect of the Tax Reform Act of 1986 on tax collections and the disruption of the timing of Treasury

Table 2

1987 Reserve Levels

In Millions of Dollars, Not Seasonally Adjusted

Period Ended	RR Current	RR First Published	ER Current	ER First Published	TR	Adj. and Seas. BR	NBR plus Extended Credit BR Current	NBR plus Extended Credit BR First Published	NBR Interim Objective*	Extended Credit BR
Jan. 14	60,680	60,822	845	707	61,525	290	61,235	61,239	61,381	215
28	57,033	57,045	1,206	1,170	58,239	462	56,791	57,754	57,782	227
Feb. 11	56,208	56,373	1,459	1,387	57,667	160	57,508	57,601	57,059	265
25	55,530	55,513	1,070	1,025	56,599	381	56,219	56,158	56,160	299
Mar. 11	56,021	56,174	961	851	56,982	191	56,791	56,835	56,814	275
25	55,866	55,966	981	868	56,847	265	56,582	56,569	56,581	263
Apr. 8	57,029	56,943	679	840	57,708	393	57,315	57,390	57,444	248
22	59,703	59,559	804	928	60,506	689	59,817	59,798	60,105	267
May 6	58,115	58,129	1,016	979	59,131	1,111	58,020	57,998	58,530	299
20	57,066	56,907	1,063	1,221	58,128	554	57,575	57,575	57,305	276
June 3	57,042	56,939	1,134	1,327	58,176	797	57,379	57,469	57,220	297
17	58,313	58,344	804	836	59,117	381	58,736	58,798	58,659	254
July 1	56,947	56,961	1,620	1,692	58,567	567	58,000	58,087	57,677	289
15	59,081	59,173	472	428	59,553	435	59,118	59,167	59,512	261
29	57,240	57,252	983	958	58,223	519	57,704	57,692	57,613	133
Aug. 12	57,488	57,597	801	725	58,289	444	57,845	57,878	57,968	120
26	57,116	57,107	1,173	1,145	58,288	591	57,698	57,662	57,480	128
Sept. 9	57,546	57,660	1,194	1,188	58,740	474	58,266	58,374	58,365	173
23	59,825	59,784	515	565	60,340	470	59,870	59,878	60,057	531
Oct. 7	59,306	59,232	833	937	60,139	726	59,413	59,443	59,477	469
21	60,115	59,970	967	1,134	61,082	525	60,557	60,580	60,102	482
Nov. 4	60,256	60,182	1,561	1,751	61,817	287	61,530	61,646	60,976	390
18	60,655	60,660	492	485	61,147	227	60,921	60,919	61,100	334
Dec. 2	59,855	59,901	1,213	1,223	61,068	218	60,850	60,906	60,342	465
16	60,890	60,959	1,206	1,192	62,095	162	61,934	61,989	61,576	653
30	61,354	61,300	806	920	62,160	355	61,805	61,865	61,828	316

*As of final Wednesday of reserve period.

debt auctions by legislative delays in raising the Treasury debt ceiling.

The Tax Reform Act of 1986 significantly raised tax flows over the year. The Act spurred individuals to liquidate assets in late 1986 in advance of the elimination of the preferential treatment of capital gains the following year. These asset sales generated huge tax liabilities that were to be paid in 1987. The historical patterns of the size and timing of individual nonwithheld income tax payments were badly distorted in January and April, making it particularly difficult to project the Treasury balance and reserve needs over these periods. Uncertainty about the impact of tax reforms on corporate tax payments (due in March, April, June, September, and December) added to the difficulty of forecasting Treasury receipts, but the forecasts of corporate payments wound up near enough to the mark that this uncertainty did not cause the Desk to miss its intended reserve provision.⁶

When the Treasury's overall cash balances exceeded the capacity of the commercial banks to hold those deposits, the excess would spill over into the Treasury's Federal Reserve balance, draining reserves from the banking system.⁷ Thus when individual nonwithheld tax payments reached record levels in January, the Desk's usual seasonal need to drain reserves was postponed. Indeed, the Treasury balance did not fall to normal levels until early February when Social Security payments were made.⁸ Frequent upward revisions of Treasury balance estimates in January required ongoing reserve injections by the Desk and led to somewhat greater-than-intended money market firmness.

Both the Federal Reserve and the Treasury anticipated unusually high April tax receipts. Indeed, the Treasury took account of the "windfall" tax collection when it cut back the size of its bill auctions and, to a lesser extent, its coupon offerings earlier in the year. By early April, corporate and individual withheld tax payments of around \$17 billion were anticipated during the month,

along with an unprecedented \$55-60 billion of nonwithheld individual income tax receipts.

As events unfolded, actual corporate tax payments came in close to expectations while individual nonwithheld tax receipts were greatly underestimated, running \$13-20 billion above Treasury and Federal Reserve estimates and \$25 billion above the 1986 level. The enormous unanticipated inflow complicated reserve management in two ways. First, as individuals built up larger-than-expected checking balances in order to pay taxes, the level of required reserves grew beyond expectations. The high checking balances persisted until a substantial portion of tax returns were processed. Second, and more important from the perspective of reserve management, the tax receipts boosted the Treasury's Federal Reserve balance to record levels. On April 30, the balance reached a high of \$29.7 billion; the previous high had been \$19.9 billion two years earlier. Together, the rise in the Treasury's balance and required reserves created an average reserve need of \$7.8 billion in the April 22 and May 6 reserve maintenance periods.

The Treasury's soaring Federal Reserve balance and higher-than-expected levels of required reserves frustrated the Desk's attempts to meet reserve needs in the April 22 and May 6 maintenance periods. The problem was exacerbated by the Desk's initially cautious provision of reserves in view of the fragility of the dollar in the foreign exchange markets and a related heightening of inflation concerns. In the April 22 period, the actual need to add reserves exceeded the need estimated at the beginning of the period by around \$2-3 billion per day. On the last day of that period, the remaining need called for \$10-11 billion of overnight RPs. Dealers presented fewer than \$6 billion of orders, so the reserve injection fell far short of the intended level and discount window borrowing spiked that day to \$5.3 billion. The need to add reserves in the May 6 period exceeded the levels forecast at the beginning of the period by an even greater amount—about \$7-8 billion per day. The Desk fell behind in meeting the growing need, and at mid-period, borrowing bulged. After adjusting for that bulge by treating a portion of it as nonborrowed reserves, the Desk was able to meet most of the period's need, in part by arranging \$45.8 billion of RPs, a record at that point. In both periods, discount window borrowing wound up well above the path allowances, averaging about \$690 million in the April 22 period and \$1.1 billion in the May 6 period.

The second major impediment to forecasting the size of the Treasury's Federal Reserve balance was the ongoing legislative controversy over the Treasury's authority to issue debt in the second half of 1987. The cancellation of scheduled auctions had two possible

⁶An IRS ruling that allowed corporations to pay 120 percent of year-earlier payments in April and June in the absence of detailed information on tax liabilities gave forecasters some help in estimating corporate receipts.

⁷Treasury cash in excess of working balances held at the Federal Reserve is channeled into so-called Treasury tax and loan note option (TT&L) accounts at depository institutions that have elected to accept them. The banks set caps on the TT&L accounts because they are required to hold collateral against them and pay interest on them. At times when the Treasury is particularly flush with cash, the TT&L accounts may fill to their capacities. Banks remit the excess of their receipts over their caps to the Treasury's account at the Federal Reserve. Thus, deposits flow out of the banking system, draining reserves.

⁸The Treasury attempts to maintain a working balance at the Federal Reserve of around \$3 billion or so and normally will either call money from or make direct investments to TT&L accounts in order to keep its Federal Reserve balance near \$3 billion.

impacts on reserve supply: If the Treasury paid down maturing issues because of an inability to issue new debt, it might have drawn down its Federal Reserve balance (when it was above normal levels), adding to the supply of reserves. On the other hand, the maturing of outstanding issues without replacement would have prevented the Fed from rolling over its holding of the maturing issues, thereby draining reserves.

The issue first arose during the July 29 maintenance period in which the debt ceiling, temporarily boosted to \$2.3 trillion, was scheduled to revert to its earlier \$2.1 trillion level. During the first week of that period, the Desk worked with two sets of forecasts, one assuming another extension, the other assuming no action.⁹ A failure to extend the ceiling would have forced the Treasury to pay down the bills maturing on July 26, \$4 billion of which were held by the System. At the same time, the Treasury would have had to call in funds from its accounts at commercial banks to make the payments, since its Federal Reserve balance was only modestly above the routine working balance level. On net, the paydown implied a substantial reserve drain from the redemption of the System's holdings that would only have been partially offset by lower Treasury balances. However, an extension of the debt ceiling would have left nonborrowed reserves near their estimated path level. Anticipating a reserve surplus the first week under both assumptions, the Desk initially drained reserves. But as it became evident that the \$2.3 trillion debt ceiling would lapse, the Desk was forced to add reserves to achieve the reserve path.

The \$2.3 trillion debt ceiling was temporarily extended on July 30 and again on August 7 to carry through September 23. Thus, estimates of reserve needs were quite tentative in the October 7 maintenance period as well. Bills that were paid down on the first day of the period were replaced on a later date than initially assumed. In this case, the paydowns actually helped reduce the need to add reserves since it brought the Treasury balance down from the high levels that followed the September corporate tax receipts by more than the drain from paying down Federal Reserve holdings. Legislation permanently raising the ceiling to \$2.8 trillion was signed on September 29.

The policy priorities changed dramatically following the worldwide plunge in stock prices on October 19. With the financial markets in turmoil, the Desk responded by providing liquidity generously and approaching policy flexibly in the weeks following the stock market crash. The approach involved giving greater weight to money market conditions in order to facilitate the return to a

⁹The reserve projection error statistics cited earlier are based on the assumption that the correct scheduling of Treasury auctions was known.

more normal functioning of financial markets and to minimize the chances that the Committee's policy intentions would be misinterpreted.

Though the level of borrowing assumed in the construction of the nonborrowed reserve path was formally lowered in three steps from \$600 million to \$400 million by November 4, actual borrowing fell further. The Desk did not attempt to force heavy late-period borrowing to achieve the assumed levels.¹⁰ In the tumultuous environment, not only did banks generally seem less inclined than normal to use the discount window, but the demand for excess reserves seemed to escalate; had the Desk forced borrowing up to the assumed levels, the result would have been a greater degree of reserve pressure than the FOMC desired. Also, required reserve estimates were quite tentative since it was not clear how long the postcrash bulge in deposits would persist.

In light of these uncertainties about reserve needs and of the generally fragile atmosphere, the Desk provided reserves generously in the November 4 maintenance period. It sought to allay market fears by entering the market before its customary intervention time on three occasions and, on one occasion, by announcing its intention to execute System RPs a day ahead of time. The System RPs helped dealers who were having trouble financing positions of Treasury and Federal agency securities through normal channels. The Desk could not help directly in the financing of mortgage-backed and other securities not eligible for System purchase, but its actions assured that, at least in the aggregate, liquidity would be ample. After showing firmness for a few days, Federal funds rates fell significantly below the levels seen prior to the stock market crash, reflecting the abundance of reserves. Excess reserves wound up at an exceptionally high \$1.6 billion level, and borrowing declined by over \$200 million from its recent average level to a level about \$100 million below the downward revised allowance.

The pattern of light borrowing continued into the next two maintenance periods. In view of the reduced demand for borrowed reserves, the Desk provided relatively more nonborrowed reserves in order to keep money market conditions from firming, and the allowance was lowered by another \$100 million on December 4 to reflect this. However, borrowing fell still further, dropping below even the lowered allowance in the December 16 maintenance period, perhaps partly reflecting concern over potential year-end funding

¹⁰Borrowing did bulge on the final day of the October 21 maintenance period, as nonborrowed reserves fell short of the intended level. Just after the Desk arranged RPs that day, reserves were plentiful. The funds rate fell in response, encouraging early withdrawals from previous days' multiday RPs. The early withdrawals reduced the surplus. Furthermore, reserve needs were greater than the Desk had realized since required reserves were higher than forecast.

pressures.¹¹

Some Treasury issues became quite scarce in the market in late October because of the heightened demands for safety and liquidity and a reluctance on the part of some financial institutions to lend securities

¹¹In the previous year, demand for bank loans had soared near year-end as businesses and investors rushed to complete transactions that would receive less favorable tax treatment beginning in 1987. Uncertain about their needs, banks became more cautious about releasing funds. Together, these factors placed extreme upward pressures on the cost of borrowing money in the market over the year-end. Thus, in 1987, banks may have been especially careful to avoid borrowing in the weeks leading up to year-end so that they could more freely access the discount window at year-end if such pressures again surfaced.

in light of concerns over the financial condition of prospective counterparties. With the concurrence of the FOMC, the Desk temporarily broadened primary dealers' access to the System's lending facilities as of October 22 in order to ease delivery problems. Specifically, the Desk suspended its normal size limitations and was willing to lend against short sales, provided that the needed securities were in the System portfolio. Dealers made moderate use of the program, increasing the average volume of securities on loan from the System to about 20 percent above the 1987 norm. The program was terminated effective November 19 when market circumstances no longer appeared to require this assistance.

*(This report was released to Congress
and to the press on June 8, 1988.)*

Treasury and Federal Reserve Foreign Exchange Operations

February-April 1988

The dollar traded in a narrower range during the three-month period ending in April than in recent reporting periods, remaining above the record lows seen at the beginning of the year against the mark and the yen (Chart 1). On balance, however, from the end of January to the end of April, the dollar declined by 1¹/₂ percent on a trade-weighted basis in terms of the other Group of Ten currencies, as measured by the index developed by the staff of the Federal Reserve Board. In particular, the dollar declined by 1/4 percent against the German mark, 2¹/₄ percent against the Japanese yen, 3³/₄ percent against the Canadian dollar, and 5³/₄ percent against the British pound.

Among the main influences on the dollar during the period were: changing expectations about the U.S. economic outlook; shifting assessments about the progress of external adjustment, prompted by data on the U.S. trade deficit; growing perceptions in the market that official policy actions, including exchange market intervention, would be taken as needed to foster greater stability of exchange rates; and improving interest rate differentials for the dollar.

There were two brief episodes of U.S. intervention to support the dollar in the foreign exchange market during the period. The U.S. authorities first intervened toward the end of March when the dollar came under selling pressure as the Japanese fiscal year was coming to a close. The second episode occurred in mid-April when

the dollar declined following the release of disappointing U.S. trade statistics for February.

February to early March

During February and early March, market participants sensed that the exchange markets for the dollar were relatively well-balanced. They saw the extent of foreign participation in the U.S. Treasury's quarterly refunding in early February as an indication that private investors had regained sufficient confidence in dollar-denominated assets to finance the large U.S. current account deficit primarily by private capital inflows. They were also inclined to believe that the monetary authorities of the major industrial nations were firmly committed to fostering exchange rate stability. Traders had been impressed by the coordinated intervention operations conducted by the United States and other authorities at the beginning of the year. Dealers continued to expect that the U.S. and other Group of Seven (G-7) authorities would intervene promptly and forcefully if necessary to counter any renewed sharp decline in the dollar. Market participants also interpreted Chairman Greenspan's testimony to the Congress as indicating that the U.S. monetary authorities would pay attention to exchange rates in administering monetary policy.

More fundamentally, many market participants became more confident that economic conditions warranted the dollar's staying around current levels for the months ahead. Though there were still some lingering concerns about the possibility of recession, traders were impressed with the resilience of U.S. output and employment after the October break in stock prices, and the prospect that interest differentials would move

A report presented by Sam Y. Cross, Executive Vice President in charge of the Foreign Group at the Federal Reserve Bank of New York and Manager of Foreign Operations for the System Open Market Account. Christopher Rude was primarily responsible for preparation of the report.

adversely for the dollar began to look increasingly remote. At the same time, some moderation of U.S. domestic demand growth was seen as helping to curb the growth of U.S. imports and thereby sustaining the needed adjustment in the U.S. trade balance. The mid-February report that the U.S. trade deficit had narrowed again in December, this time to \$12.2 billion, seemed to provide evidence that the economic adjustment process was on track.

Immediately following the release of these trade statistics, the dollar, after trading within a fairly narrow range in early February, moved up to reach its highs for the three-month period of DM1.7250, Y132.00, and \$1.7275 against the pound on February 12. The dollar then drifted lower against these three currencies over the next several weeks and on Friday, March 4, closed in New York at DM1.6895, Y128.75, and \$1.7750, respectively, almost unchanged from the levels at the beginning of the period.

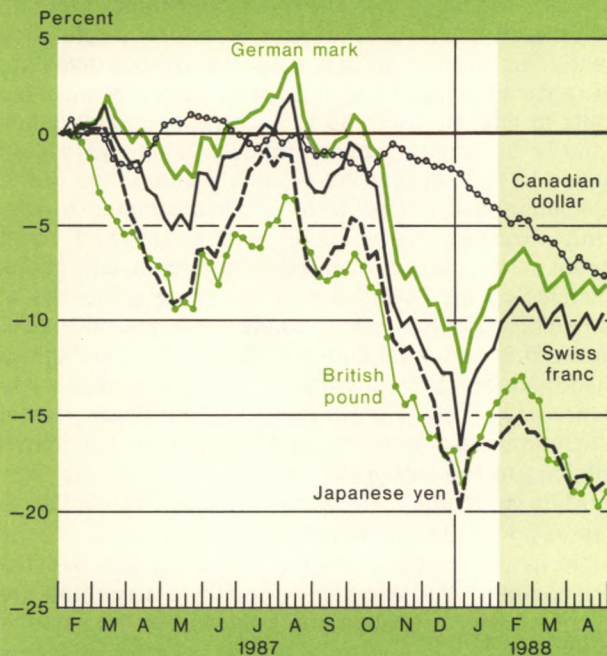
With the dollar trading within a fairly narrow range against these currencies during February and early March, investors shifted funds to currencies that offered high yields. The Canadian dollar was one of the currencies to benefit as investors were attracted by favorable interest rate differentials relative to the U.S. dollar and the Bank of Canada's strong commitment to a further deceleration of Canadian inflation.

Early to mid-March

During early March several developments led market participants to question official resolve to foster stability in exchange rates. On March 7, the British authorities chose not to resist the rise of sterling above the DM3.00 level against the mark, a level the Bank of England had defended with heavy intervention through much of the past year. Some market participants had apparently assumed that Britain's efforts to keep sterling from appreciating against the mark were associated with the G-7's commitments to foster exchange rate stability more generally. Britain's decision was, therefore, seen by those market participants as an indication of a move away from G-7 policy coordination to stabilize exchange rates. A few days later, when the Bank of France temporarily let the franc decline within the European Monetary System in the face of a large order, some market observers saw this action as possible further evidence

Chart 1

After declining sharply against most major foreign currencies toward the end of 1987, the dollar traded within a narrower range during the three-month period ending in April 1988.



The chart shows the percent change of weekly average rates for the dollar from February 6, 1987. All figures are calculated from New York noon quotations.

Table 1

Federal Reserve Reciprocal Currency Arrangements

In Millions of Dollars

Institution	Amount of Facility
	April 30, 1988
Austrian National Bank	250
National Bank of Belgium	1,000
Bank of Canada	2,000
National Bank of Denmark	250
Bank of England	3,000
Bank of France	2,000
German Federal Bank	6,000
Bank of Italy	3,000
Bank of Japan	5,000
Bank of Mexico	700
Netherlands Bank	500
Bank of Norway	250
Bank of Sweden	300
Swiss National Bank	4,000
Bank for International Settlements:	
Dollars against Swiss francs	600
Dollars against other authorized European currencies	1,250
Total	30,100

that the G-7 authorities might henceforth be prepared to allow more exchange rate movement.

About the same time, some market participants began to worry that the latest economic statistics were pointing to a new threat to the process of economic adjustment. Most notably, the report of a larger-than-expected increase in U.S. nonfarm employment in February, together with data showing increased consumer confidence and a rapid expansion of consumer credit, suggested that U.S. domestic demand was indeed stronger than had been previously expected. Market participants were concerned that, if these developments continued, the U.S. economy could soon reach capacity constraints that would choke off further export growth and provide new impetus to a rise in imports. In this environment, the dollar traded downward in early March, declining sharply against the pound and more gently against other foreign currencies.

The dollar's decline against most major foreign currencies paused in mid-March. Chairman Greenspan reiterated in Congressional testimony the need to be alert to the possibility of a reemergence of inflation and suggested the U.S. monetary authorities might adopt a tighter monetary stance, if needed. At the same time, interest rates rose in the United States, and short-term interest rate differentials favoring the dollar began to widen (Chart 2). Market observers were also reassured of the G-7 monetary authorities' intentions to maintain stability in the exchange markets when the Bank of England lowered its money market dealing rates by 1/2 percentage point on March 17 in a move thought to be designed to curb the attractiveness of sterling in the exchange market. Previously, Secretary Baker had indicated in Congressional testimony that sterling's rise above DM3.00 was not inconsistent with the G-7's December 22 statement. Of the major currencies, only the Canadian dollar continued to

rise against the U.S. dollar as the former continued to benefit from fairly wide favorable interest rate differentials.

Late March

But in late March, the dollar did not regain the buoyancy it had demonstrated earlier. Although the trade figures for January showed that the U.S. trade deficit had declined again for the third consecutive month, the exchange market reaction to the statistics was subdued. Indeed, several market participants expressed concern that future trade figures would not show much improvement because of the strength of demand in the United States. In this environment, the dollar quickly lost the boost it had received immediately on the publication of the figures.

For the rest of March, market participants remained skeptical about the outlook for the dollar. Throughout this period, the Japanese yen was the currency that gained the greatest attention. Market observers were most impressed with the apparent ability of the Japanese economy to adjust. A boost in domestic demand had spurred the economy to grow at an annual rate of 7 percent during the fourth quarter of 1987, even as the Japanese trade surplus was declining in real terms. Traders also believed that the yen was temporarily being held down ahead of the Japanese fiscal year end on March 31 because of certain tax and bookkeeping considerations. Market participants expected that the underlying strength of the Japanese economy and continuing balance of payments imbalances would cause the yen to move substantially higher once the fiscal year end passed. Moreover, some market participants worried that Japanese financial institutions would sell their dollar assets soon after the year end in order to shift their investments either to currencies with less currency risk or higher yields, or back into yen. As March came to a

Table 2

Drawings and Repayments by Foreign Central Banks under Special Swap Arrangement with the U.S. Treasury

In Millions of Dollars; Drawings (+) or Repayments (-)

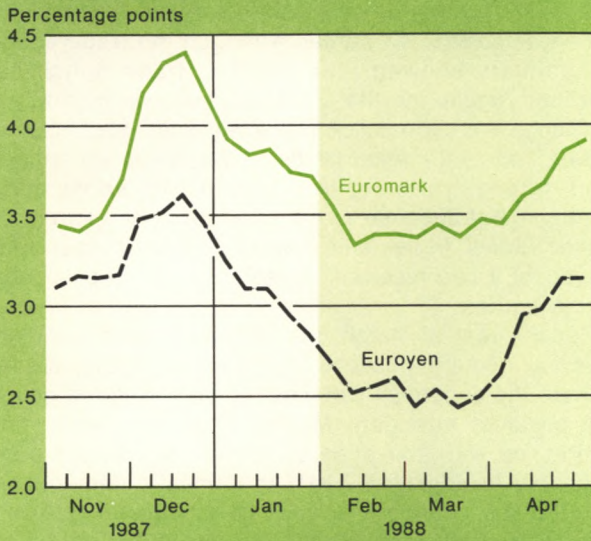
Central Bank Drawing on the U.S. Treasury	Amount of Facility	Outstanding as of February 1, 1988	February	March	April	Outstanding as of April 29, 1988
Central Bank of the Argentine Republic	550.0	*	+390.0	+160 -390	0	+160.0

Data are on a value-date basis.

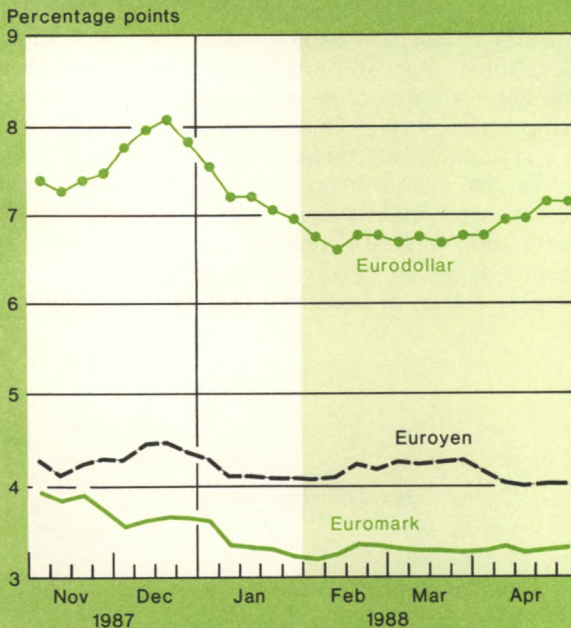
*No facility

Chart 2

Short-term interest rate differentials favoring the dollar began to increase in mid-March . . .



as interest rates rose in the United States and declined or were stable abroad.



The top chart shows weekly average interest rate differentials between three-month Eurodollar rates and the three-month Euromarket deposit rates for marks and yen. The bottom chart shows weekly average interest rates for three-month Eurodollar, Euromark, and Euroyen deposits.

close and it became apparent that the accounting constraints were becoming less binding, traders moved to establish long-yen positions against both the dollar and the mark.

Under these circumstances, the dollar resumed its decline in late March, dropping especially against the yen. By Friday, March 25, foreign exchange market conditions had deteriorated significantly, and a sharp decline in U.S. equity prices was interpreted in the market as evidence that Japanese investors had begun to liquidate dollar assets. In these circumstances, the U.S. monetary authorities intervened to limit the dollar's decline and to reassure the market, purchasing dollars against yen that day and again after the weekend on March 28. On March 29, when the dollar was moving higher, the Desk made further dollar purchases against yen to encourage the dollar's rise. Market participants were reassured by the intervention, and the dollar began to firm. The Desk's operations on these three days, totaling \$318 million against yen, were undertaken in cooperation with the Bank of Japan.

April

Foreign exchange markets in Europe and New York quieted with the approach of the long Easter weekend early in April. Nonetheless, market participants continued to express the view that Japanese investors would be unwilling to invest heavily abroad in their new fiscal year. Therefore, they questioned whether Japanese and possibly other foreign investors would have enough confidence in dollar-denominated assets to continue financing the U.S. current account deficit in the future. Thus, the dollar resumed its decline briefly and reached its lows for the three-month period of DM1.6480 and Y123.40 in Far Eastern trading on April 4. With the dollar also declining to \$1.8950 against the pound, it was down 2, 3¹/₂, and 6³/₄ percent, respectively, from its opening levels in early February.

In the event, the expected heavy dollar sales did not materialize. Moreover, U.S. interest rates had risen further following the release on April 1 of data indicating an unexpectedly large increase in U.S. nonfarm employment for March. Market participants began to reassess the outlook for the dollar and to reconsider whether their earlier concerns about a lack of investor interest in dollar-denominated assets were overdone. As market participants became more assured that private capital inflows would continue to finance the U.S. current account deficit, the dollar started to move higher.

The dollar continued to move higher in subsequent days. As evidence of sustained U.S. economic growth accumulated, market perceptions that the U.S. monetary authorities had greater scope to tighten monetary policy strengthened. The larger-than-expected employment

figures for March were followed on April 13 by a report of strong U.S. retail sales for the same month. In this context, interest rate differentials favoring the dollar widened further (Chart 3), and market participants interpreted the rise in Federal Funds rates in early April as an indication of a slight tightening in Federal Reserve policy.

Confidence in the firmness of international commitments to foster exchange rate stability was also growing. Traders looked forward to the forthcoming meeting of the G-7 industrial nations for a reaffirmation of official cooperation to stabilize exchange rates. On April 13, the G-7's official communiqué welcomed recent evidence that a correction of the world's external imbalances was underway and, as expected, reaffirmed the G-7's commitment to exchange rate stability.

A test of this commitment came the next day. To be sure, the announcement that the U.S. trade deficit had widened in February was a significant disappointment to the market and triggered an abrupt decline in dollar exchange rates (Chart 4). But market participants noted that the monetary authorities of the United States and other countries quickly intervened to stabilize the dollar. The U.S. monetary authorities bought a total of \$240 million against marks and \$260 million against yen on April 14 and 15 as the dollar briefly tested on April 14 its earlier low against the yen. The prompt and concerted response by the U.S. and foreign monetary authorities reassured the market. Consequently, after edging slightly lower to DM1.6555 as well as to a three-month low of \$1.9065 against the pound on April 18, the dollar soon stabilized.

For the remainder of April, the dollar was underpinned

Table 3

Net Profit (+) or Losses (-) on United States Treasury and Federal Reserve Foreign Exchange Operations

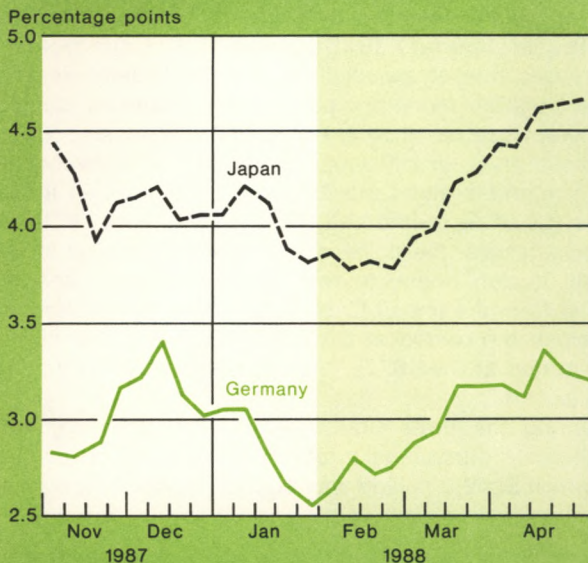
In Millions of Dollars

Period	Federal Reserve	United States Treasury Exchange Stabilization Fund
February 1, 1988 - April 30, 1988	+89.9	+50.9
Valuation profits and losses on outstanding assets and liabilities as of April 29, 1988	+1,753.6	+1,318.2

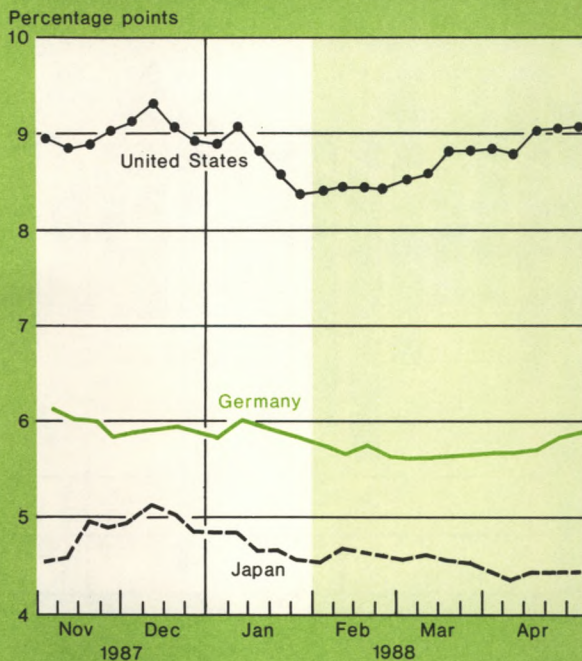
Data are on a value-date basis.

Chart 3

Long-term interest rate differentials favoring the dollar also increased during the three-month period . . .



as interest rates rose in the United States.



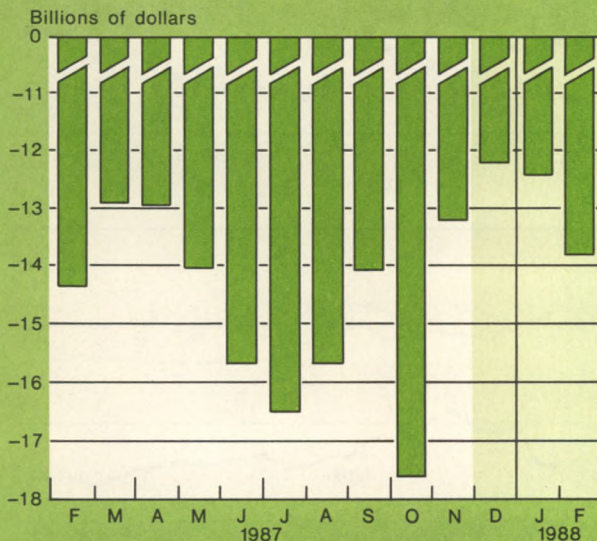
The top chart shows weekly average differentials between U.S. government long-bond yields and German and Japanese government long-bond yields. The bottom panel shows the weekly average U.S., German, and Japanese government long-bond yields.

by expectations that U.S. interest rates might continue to rise. Market participants perceived an increasing convergence of the monetary policy stance needed for domestic stability and that needed for external adjustment. News of a sharp rise in U.S. consumer prices during March, followed by evidence of strong demand in the preliminary first-quarter U.S. GNP figures, increased market expectations that the Federal Reserve might tighten monetary policy. Statements by several Federal Reserve officials, expressing concerns about the potential risks for inflationary pressures of relatively tight labor markets and capacity constraints in some industries (Chart 5), reinforced these expectations. In these circumstances, the dollar moved gradually higher in late April. It also began to recover against the Canadian dollar from the low of CAN\$1.2213 reached on April 20 to close the period at CAN\$1.2285. The dollar closed the period at DM1.6775, Y125.10, and \$1.8765 against the pound.

During the three-month period, the U.S. monetary authorities purchased a total of \$818.0 million dollars, of which \$240.0 million was against German marks and

Chart 4

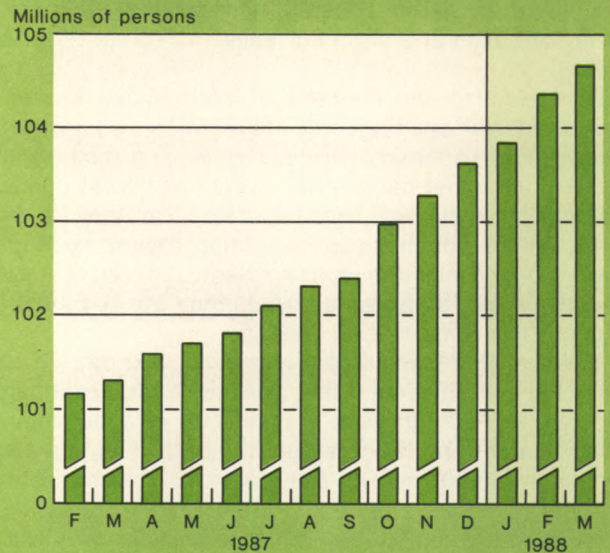
Sharply reduced U.S. trade deficits for December and January benefited the dollar early in the period, but the markets were disappointed by the deficit for February.



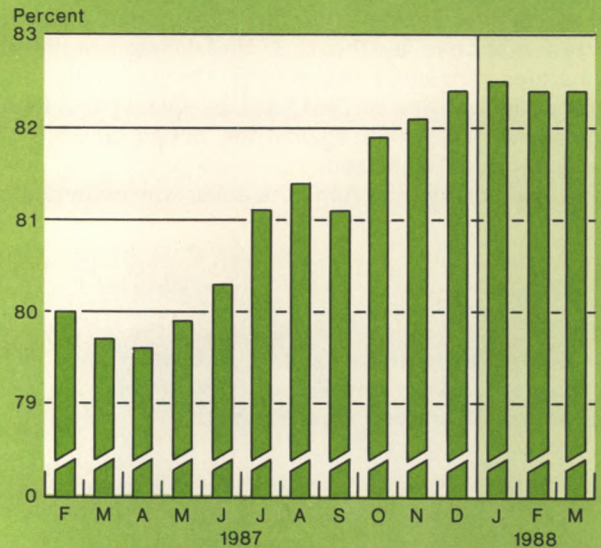
The chart shows the monthly U.S. merchandise trade balance, not seasonally adjusted, census basis. The U.S. trade figures for December, January, and February were released on February 12, March 17, and April 14, respectively.

Chart 5

During the three-month period, rising employment in the United States . . .



and signs of capacity utilization constraints in some industries . . .



reinforced concerns about both the persistence of the nation's external imbalance and inflationary bottlenecks in the economy.

The top chart shows monthly U.S. nonfarm payrolls. The bottom chart shows the degree of capacity utilization in U.S. industry. The figures for January-March were released during the three-month period under review.

\$578.0 million was against Japanese yen. The Federal Reserve provided the \$240 million equivalent of German marks as well as \$60 million equivalent of Japanese yen. The Treasury's Exchange Stabilization Fund (ESF) provided the remaining \$518 million equivalent of Japanese yen.

As in the previous period, the U.S. authorities acquired yen in various ways, including \$425.2 million equivalent of yen received through the sale of SDRs to other monetary authorities and \$2.5 million equivalent of yen received as repayment of borrowings from the United States under the Supplemental Financing Facility of the International Monetary Fund.

In the February-April period, the Federal Reserve and ESF realized profits of \$89.9 million and \$50.9 million, respectively, from foreign currency operations. As of end-April, cumulative bookkeeping or valuation gains on outstanding foreign currency balances were \$1,753.6 million for the Federal Reserve and \$1,318.2 million for the ESF. These valuation gains represented the increase in the dollar value of outstanding currency assets valued

at end-of-period exchange rates, compared with the rates prevailing at the time the foreign currencies were acquired.

The Federal Reserve and the ESF regularly invest their foreign currency balances in a variety of instruments that yield market-related rates of return and that have a high degree of quality and liquidity. A portion of the balances is invested in securities issued by foreign governments. As of end-April, holdings of such securities by the Federal Reserve amounted to \$1,024.9 million equivalent, and holdings by the Treasury amounted to the equivalent of \$945.8 million.

On February 23, 1988, the U.S. Treasury through the ESF provided a \$550 million short-term financing facility to Argentina. This facility provided for two separate drawings: the first for an amount of up to \$390 million and the second for an amount of up to \$160 million. The Central Bank of the Argentine Republic drew \$390 million on February 24 and the additional \$160 million on March 11. The first drawing of \$390 million was repaid on March 24.

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