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A Comprehensive New Real Dollar Exchange Rate Index

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In a September 1986 *Economic Review* article, the first of two new comprehensive exchange rate indexes being developed at the Federal Reserve Bank of Dallas was introduced.[1] This first index, the X-131 Dollar Index, is a *nominal* index that measures the value of the dollar against the currencies of all 131 U.S. trading partners and, thus, more accurately reflects the worldwide value of the dollar than have prior, more narrowly based indexes. The September article also reported that research was under way to provide the X-131 Index with a complementary *real* dollar index.

The article here reports on the construction of that second new exchange rate index—the RX-101 Real Dollar Index.[2] In addition, this article details the construction and importance of newly developed *sub*indexes, which measure the real value of the dollar relative to currencies of countries in six parts of the world—divided as Europe, the Pacific Newly Industrialized Countries (PACNIC), Canada, the Western Hemisphere (excluding Canada), Japan, and the other U.S. trading partners. Both the two new comprehensive indexes and the subindexes are now reported regularly on a monthly basis.[3]

Together, these new indexes should provide useful information for a variety of purposes. As a nominal index, the X-131 is helpful, for example, for studies involving currency trading, inflation, or, in some cases, U.S. trade flows.[4] The RX-101, as a real dollar index, is suited for studies of purchasing power parity or for analysis of issues involving international trade. Also, a disaggregated view based on the subindexes makes it possible to track the real dollar in various parts of the world and thus assess more accurately the factors determining the pattern of U.S. trade.

It is widely held that international trade flows depend on the *real* exchange rate, rather than on the purely nominal exchange value of *currencies*. After all, the pound sterling price of fine china and other goods in London and their dollar price in New York play just as important a role in the consumer's buying decision as does the dollar price of pounds. For this reason, the RX-101 Real Dollar Index was developed to measure the rate of exchange (or "terms of trade") between U.S. *goods* and those of other countries and as a parallel to the X-131 Index, which measures the rate of exchange between *currencies*.

The method of construction for the RX-101 Real Dollar Index follows that used elsewhere for real indexes in that exchange rate and price data are used to calculate the real value of the dollar directly. This new index differs from existing real dollar indexes, however, in that it contains nearly a full set of the U.S. trading partners (101 in all), accounting for more than 97 percent of U.S. international merchandise trade.[5]

The findings in this article imply that, for the most part, existing real indexes have adequately reflected the worldwide appreciation in the dollar over the 1980-85 period but have tended to overstate the depreciation in the dollar since

that time. Also, on the basis of the research from which the RX-101 was developed, it appears that this degree of overstatement is related directly to the narrowness of the existing real indexes. The index of the Federal Reserve Board of Governors, which contains 10 countries, shows a 39-percent depreciation in the real value of the dollar from March 1985 to September 1986. The real index of Morgan Guaranty Trust Company of New York that contains 15 countries shows a 30-percent depreciation over the same period. In contrast, Morgan Guaranty's recently published, broader real index, which contains 40 countries (25 additional countries), indicates 24-percent depreciation. But the Dallas Fed's new real dollar index reported here contains 101 countries and shows only 16-percent depreciation in the dollar's real value since March 1985.

The inclusion of a broader set of U.S. trading partners, then, has recently become a feature particularly important to the accurate assessment of the dollar's worldwide real value. Outcomes can vary substantially, depending on the countries included. While the inclusion of additional countries is more difficult computationally, it has become increasingly clear that the more countries included, the more accurate an index will be in measuring the comprehensive real value of the dollar.

The findings here also show that *single* indexes are not capable of adequately reflecting all the various worldwide changes in the real value of the dollar over the past few years.[6] In short, the goods of Europe and Japan have become relatively much more expensive while those of Canada, the PACNIC, and the Western Hemisphere (excluding Canada) have become cheaper. By nature, dollar indexes measure the aggregate, or overall, value of the dollar internationally and, thus, do not compare the dollar's value across different parts of the world. Although these aggregate measures may provide sufficient information for some purposes, they may not be adequate for others. Furthermore, as the disaggregated series reveal, it is precisely because of the disparities in the dollar's movement against various currencies, plus widely different price-level changes across countries in the case of a real index, that one can arrive at such different estimates of the dollar's appreciation or depreciation over the past few years.

Movements in any aggregate index thus depend critically on the countries included. By centering on the currencies of Europe and Japan, existing indexes have not accurately captured the movement in the dollar's real value elsewhere and, as a result, have overstated the decline in the real value of the dollar relative to a broad set of U.S. trading partners.

Construction of the RX-101 Real Dollar Index

In constructing the RX-101 Real Dollar Index, the calculation generally parallels that of the X-131 Index reported earlier.[7] Weights are based on U.S. bilateral export-plus-import trade shares, enter the index geometrically, and move over

Table 1
RX-101 REAL DOLLAR INDEX: MONTHLY, 1976–86

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	89.9	89.1	89.2	88.9	88.8	88.8	88.6	88.5	89.0	88.7	89.4	88.8
1977...	87.6	88.3	88.2	87.6	87.4	87.2	86.5	86.7	86.6	85.9	85.7	84.7
1978...	84.8	84.7	84.3	84.3	84.9	84.6	83.2	82.3	82.7	81.6	83.1	83.6
1979...	83.6	84.2	84.1	84.5	85.3	85.7	84.4	85.0	84.8	85.5	86.5	85.9
1980...	85.4	85.9	88.2	88.8	86.2	85.2	84.1	84.7	84.1	84.3	85.6	86.5
1981...	86.1	88.1	88.2	88.9	91.1	92.6	94.5	95.9	94.5	93.7	92.4	92.3
1982...	93.1	95.6	98.0	98.5	97.3	101.1	101.9	104.3	104.9	104.2	103.8	101.2
1983...	101.5	102.2	102.5	103.6	103.6	104.9	105.5	106.8	107.0	106.1	107.0	107.8
1984...	109.1	108.2	107.7	108.3	110.0	110.7	113.3	113.7	115.6	116.4	115.4	117.0
1985...	118.6	121.0	121.9	118.7	119.5	118.7	116.3	116.3	117.3	113.3	112.4	112.3
1986...	111.6	108.6	106.9	105.9	104.4	105.6	104.1	103.3	103.6	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

time.[8] [9] The RX-101 Index differs notably, however, in two ways. First, it contains the currencies of only 101 countries, rather than all 131 U.S. trading partners (as in the X-131), because price data are not available for all countries.[10] The approach is to calculate the real dollar index over all U.S. trading partners for which price data are available. These 101 countries together account for more than 97 percent of U.S. trade.[11]

The second difference concerns the nature of a real versus nominal dollar index. By construction, a real dollar index measures the trade-weighted rate of exchange between U.S. and foreign products. This calculation is accomplished by using available price indexes directly to adjust (inflate or deflate) the nominal exchange rate of each country's currency against the dollar.[12]

Some price index must therefore be selected. Because the primary purpose of constructing a real dollar exchange rate index is presumably to investigate the effects of changes in relative prices on the pattern of international trade, it might seem at first that the desired price index for each country would be that for traded goods alone. There are, however, both practical and theoretical problems with this approach.

Table 2
RX-101 REAL DOLLAR INDEX: QUARTERLY, 1971–86

Year	Q1	Q2	Q3	Q4
1971...	112.4	111.7	110.8	108.0
1972...	105.2	104.1	103.8	103.6
1973...	100.0	96.1	93.6	94.4
1974...	94.5	91.4	92.7	92.5
1975...	89.8	88.6	91.1	91.8
1976...	89.3	88.8	88.9	89.0
1977...	88.2	87.4	86.7	85.5
1978...	84.6	84.7	82.8	82.7
1979...	84.1	85.3	84.8	86.0
1980...	86.5	86.8	84.3	85.5
1981...	87.4	90.9	95.0	92.8
1982...	95.8	99.0	103.9	103.2
1983...	102.2	104.1	106.5	107.1
1984...	108.5	109.7	114.3	116.4
1985...	120.6	119.1	116.7	112.7
1986...	109.0	105.3	103.7	—

SOURCES OF PRIMARY DATA: Bank of America.
International Monetary Fund.

The first one, as noted by Samuelson, is that the bundle of traded goods for each country tends to be subject to relatively major changes, leading to difficulty in the proper comparison of prices of traded goods over time.[13] The recent emergence of the Korean automobile market, for example, has led to substantial changes in the composition of exports from Korea and, thus, has inevitably led to changes in the makeup of traded goods prices (as well as wholesale goods prices) in that country.

More important, however, as Keynes pointed out, is that an international comparison of purchasing power parity (PPP) from traded goods prices alone is close to a truism.[14] Keynes argued, as Officer notes, that "WPIs [wholesale prices] are a poor basis for computing PPP. The reason is that such indices are heavily weighted with traded goods . . . and therefore relative price parities calculated from these indices come close to the actual exchange rate, resulting in a spurious verification of the [PPP] theory."[15] This reasoning argues for a more broad-based measure of prices. The index of consumer prices is such a measure and has the added advantage of being the most widely available across countries.

Given these price and exchange rate data for each country, the RX-101 Index may be directly calculated on a trade-weighted basis as

$$(1) \qquad E_t = 100 \prod_{i=1}^{101} \left[\left(\frac{E_t^i P_t^{US}}{P_t^i} \right) \Big/ \left(\frac{E_B^i P_B^{US}}{P_B^i} \right) \right]^{w_T^i},$$

where

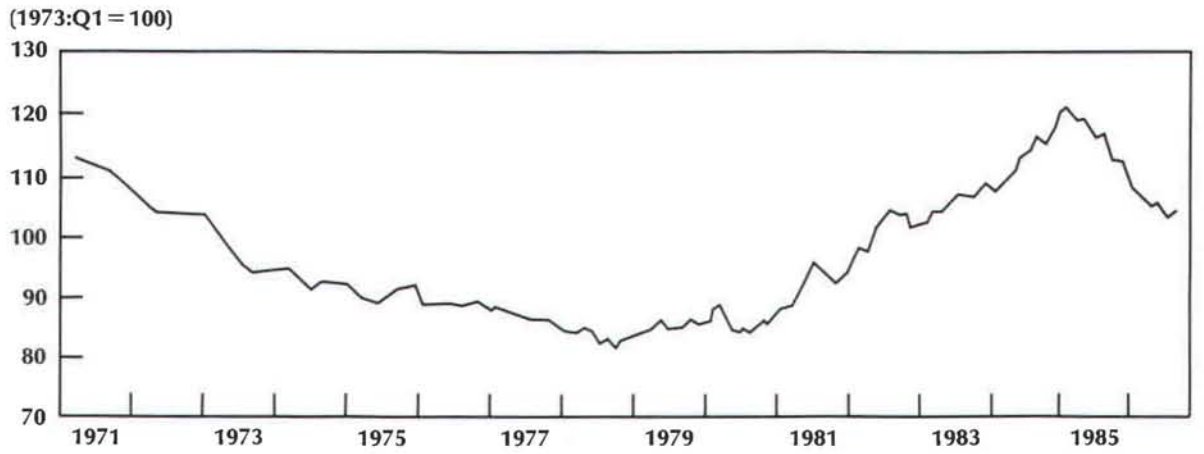
E_t = the RX-101 Real Dollar Index in period t,
E_t^i = the number of units of currency i per dollar in period t,
P = the consumer price index in period t,
B = the base period (first quarter 1973),

$$w_T^i = \frac{X_T^i + M_T^i}{\sum_{i=1}^{101} (X_T^i + M_T^i)}$$

= the trade weight assigned country i in year T (the year during which period t occurs),
X_T^i = U.S. exports to country i in year T, and
M_T^i = U.S. imports from country i in year T.[16]

Table 1 reports the new real dollar index on a monthly basis from January 1976 to September 1986.[17] Quarterly data for the period from the first quarter of 1971 to the third quarter of 1986 are provided in Table 2, and the index is plotted in Figure 1.[18]

Figure 1
RX-101 Real Dollar Index



As Figure 1 shows, the comprehensive real value of the dollar has ranged from a low of roughly 81.6 to a high of 121.9 over the 1971-86 period, with an overall mean of 97.2 and a standard deviation of 10.7.[19] The real value of the dollar fell steadily throughout the early to middle 1970s, eventually settling during 1976 in the high 80s. The period from 1976 to 1980 was one of remarkable stability in the real dollar, with its value remaining solidly in the range of the 80s and reaching a minimum of approximately 81.6 in October 1978. Although this was the trough of the dollar's real value for the 1971-86 period, no appreciable long-term upswing directly followed, as the dollar's real value rose to near 89 but then fell back to 84.1 in September 1980. At this point, the dollar's extended run-up began. The RX-101 Index indicates that the real value of the dollar rose steadily over the 4½ years following September 1980, eventually appreciating 37.1 percent to a peak of 121.9 in March 1985. Since that peak, until September 1986, the RX-101 Index shows roughly a 16.3-percent depreciation in the comprehensive real value of the dollar.[20]

A disaggregated view of the real dollar

In this section, attention is turned to a disaggregated view of the real dollar internationally. Specifically, dollar *sub*indexes are constructed to measure the real value of the dollar relative to currencies in different parts of the world—Europe, the Pacific Newly Industrialized Countries, Canada, Japan, the Western Hemisphere (excluding Canada), and the other U.S. trading partners.[21]

The construction of the real dollar subindexes parallels that of the aggregate index except that the currencies and trade weights used in calculating the dollar's real value are limited to those of a specific country group. The Appendix details the construction of the real dollar subindexes. Tables B through G in the Appendix report the six subindexes on a monthly basis over the 1976-86 period.

Of primary interest here is a comparison of the behavior of the subindexes. For this purpose, it is helpful to illustrate each series graphically. Figure 2 contains the subindexes plotted monthly over the January 1980-September 1986 period. A comparison yields several interesting observations.

First, it is important to note the disparity in the behavior of the six subindexes over the 1980-86 period. Although the comprehensive RX-101 Index indicates an overall pattern of 37-percent appreciation in the value of the dollar followed by 16-percent depreciation during the 1980-86 period, this pattern clearly is not found evenly across the subindexes. Over the September 1980-March 1985 period of general appreciation in the real dollar, for example, the real value of the dollar rose 32 percent relative to the Japanese yen; 66 percent, to the currencies of Europe; 29 percent, to the PACNIC currencies; 26 percent, to the currencies of the Western Hemisphere; 8 percent, to the Canadian dollar; and 48 percent, to the currencies of the other U.S. trading partners.

Even more striking, and perhaps more interesting, is that this disparity has widened since March 1985. The real value of the dollar has fallen 49 percent against the yen and 40

Figure 2

Real Value of the Dollar, by Country Subgroup

(1973:Q1 = 100. Figures in parentheses represent the share of total U.S. trade for 1985)

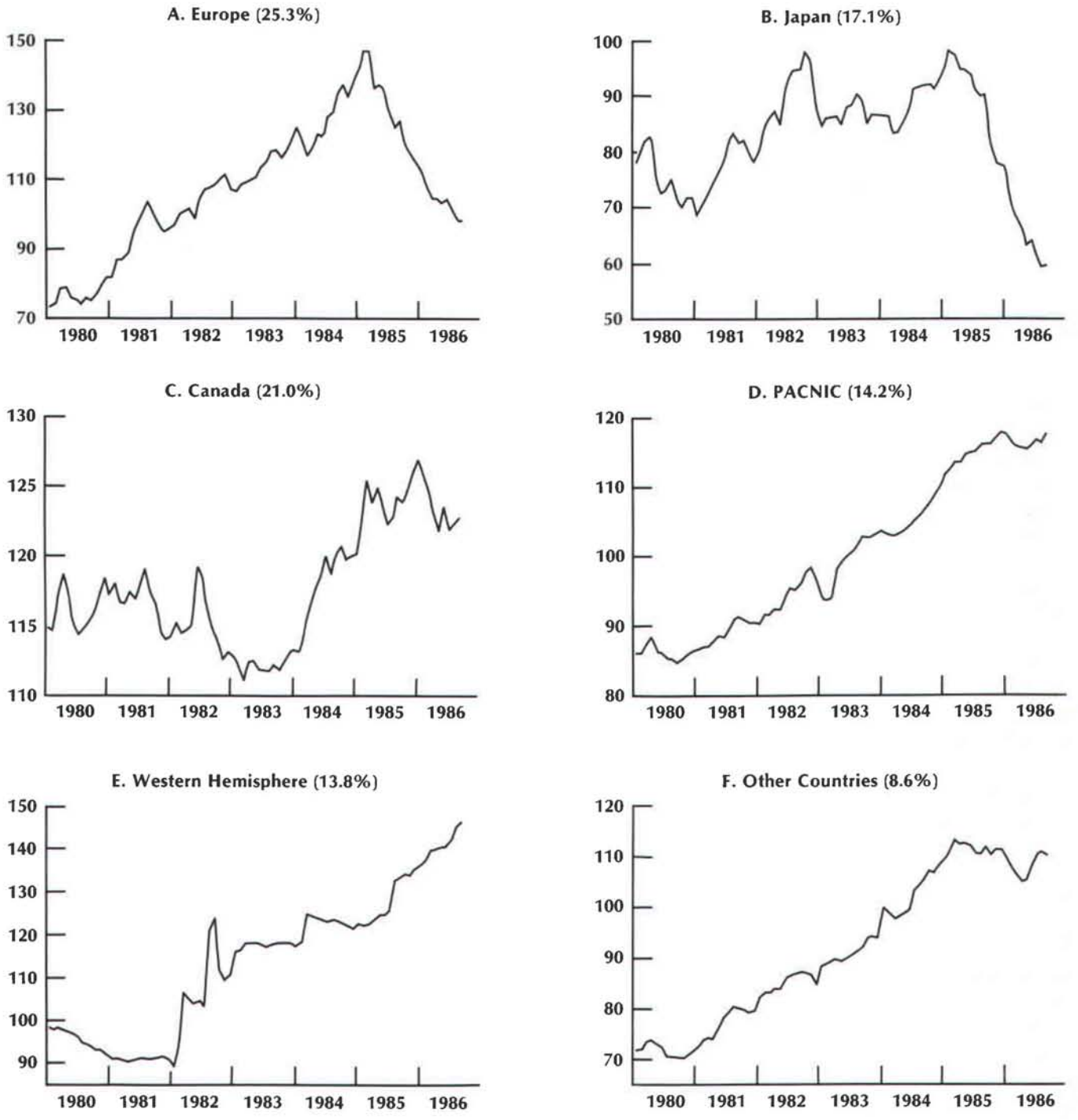


Table 3
CORRELATION BETWEEN THE RX-101 REAL DOLLAR INDEX, ITS SUBINDEXES, AND OTHER REAL DOLLAR INDEXES: SEPTEMBER 1980–SEPTEMBER 1986

	Real subindexes							Other real indexes		
	Canada	Japan	PACNIC[1]	Europe	Western Hemisphere[2]	Other countries	RX-101	Board	Morgan (15)	Morgan (40)
Real subindexes										
Canada	1.000	.347	.357	.435	−.156	.322	.503	.457	.470	.416
Japan	.347	1.000	.500	.763	−.072	.439	.857	.830	.873	.862
PACNIC[1]	.357	.500	1.000	.416	−.240	.132	.445	.471	.462	.431
Europe	.435	.763	.416	1.000	−.148	.567	.896	.988	.952	.932
Western Hemisphere[2]	−.156	−.072	−.240	−.148	1.000	−.085	.178	−.141	−.144	.034
Other countries	.322	.439	.132	.567	−.085	1.000	.597	.553	.523	.486
RX-101	.503	.857	.445	.896	.178	.597	1.000	.922	.913	.944
Other real indexes										
Board	.457	.830	.471	.988	−.141	.553	.922	1.000	.977	.957
Morgan (15)	.470	.873	.462	.952	−.144	.523	.913	.977	1.000	.979
Morgan (40)	.416	.862	.431	.932	.034	.486	.944	.957	.979	1.000

1. Pacific Newly Industrialized Countries.
2. Excluding Canada.
NOTE: All correlations are in terms of growth rates of indexes.

percent against the currencies of Europe; but it is down only 2 percent against the Canadian dollar and 2 percent against the "other" currencies while *rising* 3 percent relative to the PACNIC currencies and 18 percent relative to the currencies of the Western Hemisphere.

In order to assess the degree of comovement in the subindexes more accurately and to examine the statistical relationship between each of the subindexes and the comprehensive RX-101 Real Dollar Index, it is helpful to correlate the series statistically. Table 3 details the correlation between the RX-101 Index and its subindexes, as well as other real dollar indexes. Specifically, each entry in the table gives the correlation between the percentage growth in one index (or subindex) and another index from September 1980 to September 1986.

It should be noted first that the correlation between the overall RX-101 Index and its individual subindexes is highest for the Europe subindex. This is not surprising, given the relatively high trade-weight representation of European currencies in the overall index. The subindex for Europe, however, clearly does *not* generally reflect the behavior of the real dollar in other parts of the world, as there is substantial variation in the degree of comovement across the subindexes. The behavior of the real dollar in Europe and in Japan appears to be correlated relatively highly, but that for Japan or Europe vis-à-vis any of the remaining subindexes does not. As a whole, the subindexes of the PACNIC, the Western Hemisphere, and the "other countries" appear to behave fairly independently. This is also largely true of the subindex for Canada. In short, the disaggregated series reveal striking disparities in the behavior of the dollar internationally over the past few years, so no *single* index is able to communicate the various worldwide changes in the dollar's real value.

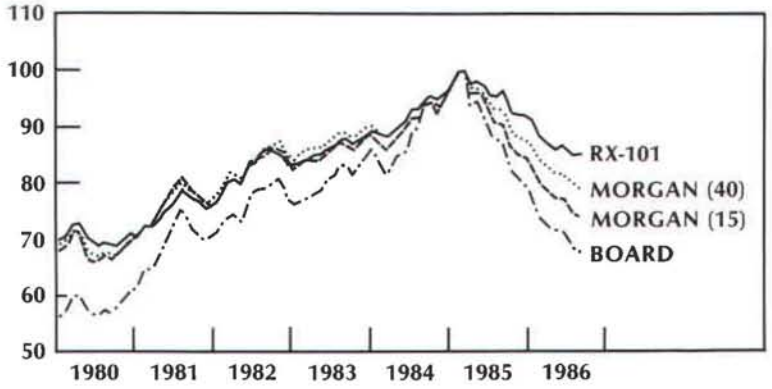
A detailed comparison of alternative dollar indexes

This section compares the behavior of various real dollar indexes. Specifically compared are the real indexes of the Federal Reserve Board of Governors, Morgan Guaranty Trust Company (two indexes), and the RX-101 Index reported here.

Traditionally, real exchange rate indexes have measured the value of the dollar against a relatively narrow set of countries. The real dollar index of the Board of Governors, for example, contains the currencies of 10 countries (Germany, Japan, Canada, France, the United Kingdom, Italy,

Figure 3
Real Dollar Indexes: RX-101, Morgan Guaranty, and the Board

(March 1985 = 100)



SOURCES OF PRIMARY DATA: Board of Governors, Federal Reserve System.
Morgan Guaranty Trust Company of New York.
Federal Reserve Bank of Dallas.

the Netherlands, Belgium, Sweden, and Switzerland), to which Morgan Guaranty has provisionally added 5 countries (Australia, Austria, Denmark, Norway, and Spain) for a total of 15 in its index. Recently, however, Morgan Guaranty has published a more complete real dollar index embracing the currencies of 40 countries.

The RX-101 Index is plotted in Figure 3, along with the Board's real index and the two Morgan Guaranty indexes, for January 1980 to September 1986. For the sake of visual comparison and so that the exchange rate indexes have a common value of 100 at their peak, each series was first divided through by its value in March 1985.[22]

As Figure 3 shows, the real value of the dollar appreciated substantially over the 1980-85 period, and it has subsequently declined, according to each of the indexes. The *extent* of the real dollar's appreciation and (in particular) its

Table 4
BEHAVIOR OF REAL DOLLAR INDEXES: SEPTEMBER 1980–SEPTEMBER 1986

Real dollar index (Number of countries)	Movements in the real dollar	
	Appreciation: September 1980–March 1985	Depreciation: March 1985–September 1986
	Percent	
Board of Governors, Federal Reserve System (10)[1]	56.4	–38.8
Morgan Guaranty Trust Company of New York		
Morgan (15)[1]	41.3	–30.4
Morgan (40)[1]	40.1	–23.8
Federal Reserve Bank of Dallas, RX-101 (101)	37.1	–16.3

1. Index peak is in February 1985.

depreciation, however, differs noticeably between the indexes. Table 4 shows the calculated appreciation and depreciation in the real value of the dollar according to each of the four indexes for September 1980 to September 1986.

Several conclusions are apparent from Figure 3 and Table 4.[23] The first is that the Board's real index has tended to exaggerate the swings in the real value of the dollar, as measured on a comprehensive worldwide basis. For the period from September 1980 to March 1985, for example, this 10-country index indicates more than 56-percent appreciation in the real value of the dollar, compared with calculations ranging from 37 percent to 41 percent by the other real indexes. Similarly, the Board's real index indicates 39-percent depreciation in the real value of the dollar since March 1985, compared with an average of 23 percent calculated across the other three real indexes.

More importantly, as Figure 3 and Table 4 show, the RX-101 Index and Morgan Guaranty's real indexes tended to track each other closely over the period of appreciation of the dollar but have subsequently diverged. For September 1980 to March 1985, Morgan Guaranty's 15-country index and 40-country index showed appreciation of 41 percent and 40 percent, respectively, in the real value of the dollar, and the RX-101 Index indicated 37-percent appreciation. But since March 1985, over the period of *depreciation* in the real value of the dollar, Morgan Guaranty's 15-country index and 40-country index showed 30-percent and 24-percent depreciation in the real value of the dollar, compared with only 16 percent calculated by the comprehensive new RX-101 Real Dollar Index.

There is, then, a clear pattern of diminution in the dollar's calculated depreciation as the dollar is judged against the currencies of successively more U.S. trading partners over the post-March 1985 period. The explanation is that the more narrow indexes tend to focus on the currencies of Europe and Japan—against which the dollar has depreciated the most in recent months. Through lowering the estimated depreciation in the dollar's real value from 30 percent to 24 percent when moving from a 15-country to a 40-country index, Morgan Guaranty's extension confirms the need for a more broad-based measure of the dollar's effective foreign exchange value than was previously available.

To get further insight into the nature of existing real indexes, it is helpful to return to Table 3. As that table shows, the most narrow indexes—the Board's index and Morgan Guaranty's 15-country index—tend to be highly correlated with the Europe subindex, more highly correlated in fact than with the comprehensive world real value of the dollar. Again, this relationship is to be expected, given the fairly high trade weights assigned to Europe in each of these narrow dollar indexes. This pattern is reversed, however, when moving to Morgan Guaranty's 40-country index. That is, of the existing real indexes, the 40-country index is the only one whose correlation with RX-101 exceeds that with the subindex for Europe, again confirming the need for a more broad-based measure of the dollar's real foreign exchange value.[24]

Summary and conclusions

This article completes the presentation of two new comprehensive exchange rate indexes—one nominal, the X-131 Dollar Index, and one real, the RX-101 Real Dollar Index—being developed at the Federal Reserve Bank of Dallas. Also reported are newly developed *sub*indexes, which provide a disaggregated view of the dollar internationally.

The findings here show that when measured on a comprehensive worldwide basis, the real value of the dollar has declined only 16 percent since its peak in March 1985. Earlier estimates of the dollar's real decline range from 30 percent to 39 percent, as made by narrow real dollar indexes of the Board (10 countries) and Morgan Guaranty (15 countries), but estimates fall to 24 percent with Morgan Guaranty's extension to a 40-country index and to only 16 percent when extended to the 101 countries embodied in RX-101 (over 97 percent of the U.S. trade). The inclusion of a broad set of U.S. trading partners has thus become a feature particularly important to the accurate assessment of the dollar's real foreign exchange value.

When disaggregated, the dollar's real value shows substantial disparity internationally over the past few years. This has been true especially since March 1985, as the real dollar has *fallen* 49 percent against the Japanese yen, 40 percent against the European currencies, and 2 percent against the Canadian dollar while *rising* 4 percent relative to the PACNIC currencies and 18 percent relative to the currencies of the Western Hemisphere (excluding Canada).

The goods of Europe and (in particular) Japan have become relatively more expensive over the past two years, while those of the PACNIC and the Western Hemisphere have become cheaper. By centering on the currencies of Europe and Japan, existing real indexes have not provided a broad-based view of the recent worldwide movements in the real value of the dollar. Thus, the comprehensive real dollar exchange rate index introduced here, together with the disaggregated subindexes, should offer useful new tools for analyzing issues involving international trade.[25]

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1. See W. Michael Cox, "A New Alternative Trade-Weighted Dollar Exchange Rate Index," Federal Reserve Bank of Dallas *Economic Review*, September 1986, 20-28, for an exposition of the X-131 Nominal Ex-

change Rate Index and for a review of other work on nominal indexes. For other studies or related data on real exchange rate indexes, see several excerpts from Morgan Guaranty Trust Company of New York, *World Financial Markets*: "Effective exchange rates: update and refinement," August 1983, 6-13; "Measuring competitiveness," July 1983, 8-13; and "Effective exchange rates: nominal and real," May 1978, 3-15. See also Table B-105, "Exchange Rates, 1967-85," in *Economic Report of the President, February 1986* (Washington, D.C.: Government Printing Office, 1986), 373. For additional Federal Reserve publications regarding exchange rate indexes, see Peter Hooper and John Morton, "Summary Measures of the Dollar's Foreign Exchange Value," *Federal Reserve Bulletin* 64 (October 1978): 783-89; Jeffrey A. Rosensweig, "A New Dollar Index: Capturing a More Global Perspective," Federal Reserve Bank of Atlanta *Economic Review*, June/July 1986, 12-22; Gerald Anderson and Peter Skaperdas, Federal Reserve Bank of Cleveland, "A New Trade-Weighted Index for the Dollar" (Presentation before Federal Reserve System Committee on International Economic Analysis, Federal Reserve Bank of Boston, Boston, Mass., 9 October 1986); and Jack L. Hervey and William A. Strauss, "The International Value of the Dollar: An Inflation-Adjusted Index," Federal Reserve Bank of Chicago *Economic Perspectives*, January/February 1987, 17-28.

2. Since, by construction, a real dollar exchange rate index is designed to measure the rate of exchange between *goods* of countries, as opposed to their currencies, it may seem oxymoronic to refer to such indexes as "real dollar" indexes. This terminology is, nevertheless, conventional and will be followed here.

3. In "Trade-Weighted Value of the Dollar," a monthly statistical release of the Federal Reserve Bank of Dallas.

4. Specifically, the X-131 Index is suitable for studies involving U.S. international trade flows when used jointly with an appropriate price index for the United States and for its trading partners.

5. Focus throughout the study is on merchandise trade.

6. A useful analogy is that of the stock market and the Dow Jones industrial average (DJIA). By construction, the DJIA measures the combined performance of 30 stocks, all of which are specifically industrial. The overall stock market, however, consists of not only the stocks of industrial companies but also those of utility companies, transportation companies, and others. Sometimes, the DJIA may correlate well with the stocks of other economic sectors, and thus with the overall stock market, and sometimes it may not.

7. See Cox, "A New Alternative Trade-Weighted Dollar Exchange Rate Index."

8. The moving-trade-weight approach adopted here is similar (though not identical) to the chain principle originally suggested by Alfred Marshall, "Remedies for Fluctuations of General Prices," *Contemporary Review* 51 (March 1887): 355-75, and later investigated by Irving Fisher, *The Making of Index Numbers: A Study of Their Varieties, Tests, and Reliability* (Boston and New York: Houghton Mifflin Company, 1922). For a discussion of the advantages and disadvantages of various approaches to calculating index numbers, see W. E. Diewert, "Index Numbers," Discussion Paper no. 86-33, University of British Columbia, Department of Economics (Vancouver, B.C., Canada, August 1986).

   One aspect of the moving-trade-weight feature should be brought out here for studies investigating the impact of exchange rates on international trade flows. Consider the general (and likely) example wherein the dollar depreciates unevenly across the world, falling by, say, 40 percent relative to the currencies of one group of countries but by only 5 percent relative to the others. In this case, U.S. international trade flows may potentially shift from one group of countries to the other (the extent to which depends on tariffs, trade restrictions, elasticities of substitution between products internationally, and other factors), thus leading to a change in trade weights and to a possible simultaneity bias. The extent of this simultaneity bias is an econometric question. But because the trade weights used here are *export-plus-import* weights, the bias is likely to be smaller. This reduced bias occurs because, using the above example, imports from the first group of countries to the United States are likely to fall but U.S. exports are likely to rise (and vice versa for the other group of countries), so the overall export-plus-import trade weight may not be significantly affected.

   In the present research, in order to determine the degree to which the moving-trade-weight feature affected the behavior of the comprehensive dollar index, a real exchange rate series was also calculated using constant (1980) weights. The results of that process indicate a 35-percent appreciation in the dollar over the September 1980-March 1985 period and a 13-percent depreciation subsequently, compared with 37 percent and 16 percent, respectively, reported here for the RX-101.

9. The Morgan Guaranty indexes also use bilateral trade weights, whereas the weights in the Board's index are determined multilaterally (again, though, using only 10 countries). For a discussion of multilateral weights, see Hooper and Morton, "Summary Measures of the Dollar's Foreign Exchange Value."

10. The ideal approach would be to use price and exchange rate data for *all* countries, so that the real value of the dollar could be measured relative to the currencies of all U.S. trading partners. While exchange rate data are generally available, price data are not. Where available, these price data also typically lag by three to four months.

11. During the period of this study, the United States traded with 131 countries (132, including the Soviet Union), of which the 101 contained here account for approximately 97.5 percent of U.S. trade (the Soviet Union is the largest omitted U.S. trading partner and accounts for approximately 0.9 percent of U.S. exports plus imports). The remaining trade weights have been adjusted to reflect the exclusion of countries.

12. One alternative procedure sometimes adopted to estimate changes in the dollar's real value is to construct an index using the top 10 to 20 U.S. trading partners and to inflation-adjust the exchange rates of the countries contained therein for which inflation rates are "relatively" high. The yield of such a procedure is neither a real dollar index nor a nominal index but some combination of the two and, thus, cannot be compared directly with the RX-101 Real Dollar Index constructed here or with the X-131 Nominal Dollar Index constructed earlier.

13. See Paul A. Samuelson, "Theoretical Notes on Trade Problems," *Review of Economics and Statistics* 46 (May 1964): 145-54.

14. See John Maynard Keynes, *A Treatise on Money*, 2 vols. (New York: Harcourt, Brace and Company, 1930), 1:72-73.

15. Lawrence H. Officer, "The Purchasing-Power-Parity Theory of Exchange Rates: A Review Article," *International Monetary Fund Staff Papers* 23 (March 1976): 14.

16. The primary motivation for choosing the first quarter of 1973 as the period on which to base the series is that it centers on the most commonly used point of transition to floating exchange rates.

17. Because of the incomplete nature of available trade data, prior-year weights are used in calculating current-year figures for the RX-101 Real Dollar Index. Thus, current-year numbers should be regarded as preliminary, though little change is anticipated.

18. In Figure 1, over the period from 1971:Q1 to 1975:Q4, monthly observations for the RX-101 Index are obtained by interpolation of the quarterly series.

19. In calculating the mean and standard deviation of the series, the quarterly data are used.

20. Throughout the present article, all percentage appreciation and depreciation figures are calculated on a logarithmic basis. That is, the percentage difference between the real exchange rate (E) in period t and that in period $t + 1$ is calculated as $\ln(E_{t+1}/E_t)$.

21. Over the period of this study, the U.S. trade weight with Europe has ranged from 24.7 percent to 31.9 percent; with Canada, from 17.6 percent to 26.9 percent; with Japan, from 11.0 percent to 17.1 percent; with the PACNIC, from 5.9 percent to 14.4 percent; and with the Western Hemisphere, from 13.1 percent to 17.1 percent. In 1985 (the most recent full year for which data are available), roughly 25 percent of U.S. exports plus imports were with Europe; 21 percent with Canada; 17 percent with Japan; 14 percent with the PACNIC; 14 percent with the Western Hemisphere; and 9 percent with the other U.S. trading partners. (See the Appendix for a complete listing of the countries contained in each of these groups.)

22. In cases where the index peak occurs in February (rather than in March), the series has been divided through by its value in that month.

23. Notice also from Table 4 that, according to the RX-101, less than half the dollar's earlier appreciation has been reversed. This is in contrast to the behavior of the more narrowly based indexes, which show much higher depreciation-to-appreciation ratios.

24. The relation of the RX-101 Real Dollar Index to its nominal counterpart, the X-131 Dollar Index introduced in an earlier issue of this *Review*, also should be noted. Statistical correlation of the RX-101 Real Dollar Index and its subindexes with traditional nominal dollar indexes and the X-131 Dollar Index indicates that the X-131 Index is the only one whose correlation with RX-101 exceeds its correlation with the Europe subindex. In addition, the correlation between the RX-101 Index and the nominal indexes is highest relative to the X-131 Index, at approximately 0.928 over the September 1980-March 1985 period and 0.979 since that time. Despite this marked correlation, these findings should not be interpreted as necessarily implying that the broad-scaled X-131 Nominal Index is a good surrogate for measuring the comprehensive real value of the dollar. As stated earlier, the X-131 Index was not developed to measure the real value of the U.S. dollar; rather, it was constructed to provide a comprehensive measure of the worldwide nominal value of the dollar and as a parallel for the RX-101 Real Dollar Index.

25. The author is currently in the process of empirically examining the ability of the RX-101 Real Dollar Index and the real subindexes introduced here to explain international trade flows.

Appendix

Construction of the Real Dollar Subindexes

Calculation of the real dollar subindexes parallels that of the overall RX-101 Real Dollar Index except that the currencies contained in each of the subindexes are limited to a selected set of countries. The PACNIC subindex, for example, is constructed as

$$(A.1) \qquad E_t = 100 \prod_{i=1}^{8} \left[\left(\frac{E_t^i P_t^{US}}{P_t^i} \right) \Big/ \left(\frac{E_B^i P_B^{US}}{P_B^i} \right) \right]^{w_T^i}$$

The eight countries over which the subindex is calculated are those of the PACNIC group (shown in Table A here), and the trade weights are now calculated as inter-PACNIC weights, specifically

$$(A.2) \qquad w_T^i = \frac{X_T^i + M_T^i}{\sum_{i=1}^{8} \left(X_T^i + M_T^i \right)},$$

with all other variables as defined in the text. A similar approach is followed to construct each of the other subindexes.

Table A lists (in declining trade-weight order) the countries contained in each of the real dollar subindexes. Tables B through G report the real dollar subindex data monthly over the January 1976-September 1986 period.

Table A
COUNTRY COMPOSITION OF VARIOUS REAL DOLLAR SUBINDEXES

Subindex	Number of countries	Country names[1]
Canada	1	Canada
Japan	1	Japan
PACNIC[2]	8	Taiwan, Korea, Hong Kong, China, Singapore, Indonesia, Malaysia, Thailand
Europe	20	Germany, United Kingdom, France, Italy, Netherlands, Belgium-Luxembourg, Sweden, Switzerland, Spain, Denmark, Ireland, Turkey, Norway, Finland, Austria, Portugal, Yugoslavia, Greece, Iceland, Malta
Western Hemisphere	22	Mexico, Brazil, Venezuela, Colombia, Ecuador, Trinidad and Tobago, Dominican Republic, Peru, Chile, The Bahamas, Netherlands Antilles, Panama, Costa Rica, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Uruguay, Barbados, Suriname, Paraguay
Other countries	49	Australia, Saudi Arabia, Israel, India, Nigeria, Philippines, South Africa, Egypt, New Zealand, Pakistan, Iran, Kuwait, Congo, Côte d'Ivoire, Gabon, Zaire, Cameroon, Sri Lanka, Morocco, Tunisia, Sudan, Ethiopia, Bahrain, Kenya, Liberia, Ghana, Zambia, Syrian Arab Republic, Mauritius, Madagascar, Papua New Guinea, Senegal, Cyprus, Somalia, Nepal, Malawi, Sierra Leone, Togo, Burkina Faso, Western Samoa, Burma, Niger, Swaziland, Rwanda, The Gambia, Seychelles, Afghanistan, Burundi, Central African Republic
RX-101	101	All countries listed above

1. In descending trade-weight order, based on 1985 U.S. exports plus imports.
2. Pacific Newly Industrialized Countries.

Table B
REAL DOLLAR SUBINDEX: CANADA

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	97.9	96.6	95.7	95.4	95.0	94.3	94.3	95.7	94.6	94.1	95.4	98.5
1977...	97.5	99.2	101.1	101.3	100.7	101.6	101.4	102.8	102.3	104.1	104.9	103.4
1978...	104.1	105.2	105.9	108.1	105.5	106.0	105.5	107.5	111.0	112.3	111.0	111.9
1979...	113.0	113.8	111.4	109.3	110.5	112.8	112.3	113.7	113.4	114.5	114.9	114.5
1980...	114.9	114.7	116.9	118.7	117.3	115.1	114.3	114.8	115.3	115.8	117.0	118.4
1981...	117.2	118.0	116.7	116.6	117.4	116.9	118.0	119.1	117.3	116.5	114.4	114.0
1982...	114.3	115.3	114.4	114.7	115.1	119.2	118.7	116.1	114.7	113.9	112.6	113.2
1983...	112.8	112.3	111.1	112.5	112.5	111.9	111.9	111.8	112.3	111.9	112.5	113.1
1984...	113.3	113.2	115.1	116.3	117.8	118.6	120.1	118.7	120.2	120.7	119.7	120.1
1985...	120.1	122.5	125.5	123.8	125.0	123.9	122.3	122.9	124.2	123.9	124.8	126.1
1986...	127.0	125.8	124.8	123.1	121.8	123.6	121.9	122.4	122.9	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

Table C
REAL DOLLAR SUBINDEX: JAPAN

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	89.9	88.6	88.2	86.0	86.2	86.6	85.2	85.0	82.4	83.2	84.6	83.7
1977...	82.5	81.1	79.9	77.7	78.2	77.6	75.8	76.5	75.7	72.1	70.3	69.7
1978...	69.8	69.6	66.9	64.0	65.6	63.1	59.0	55.8	56.2	54.6	57.7	59.5
1979...	60.4	62.2	63.9	66.9	67.9	68.7	68.1	70.0	71.2	73.6	79.2	78.2
1980...	77.8	80.2	82.2	82.8	75.2	72.4	73.3	75.0	71.4	70.0	71.8	71.7
1981...	68.7	70.8	72.1	74.2	76.1	77.8	81.6	83.3	81.5	81.9	79.5	77.9
1982...	80.2	84.4	86.2	87.4	85.0	91.1	93.7	94.6	94.8	97.9	96.4	87.9
1983...	84.5	86.1	86.3	86.4	84.9	87.7	88.5	90.5	89.3	85.2	86.6	86.7
1984...	86.7	86.5	83.4	83.5	85.3	87.1	90.9	91.8	91.9	92.1	91.2	92.8
1985...	95.1	98.1	97.6	94.8	94.9	94.2	91.4	90.1	90.1	81.2	77.9	77.7
1986...	76.5	70.6	68.1	66.5	63.2	64.3	60.9	59.3	59.6	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

Table D

REAL DOLLAR SUBINDEX: PACIFIC NEWLY INDUSTRIALIZED COUNTRIES (PACNIC)

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	82.0	81.5	81.2	81.1	81.0	80.8	80.9	80.5	80.2	80.3	80.2	80.3
1977...	79.7	80.1	80.4	80.8	80.9	80.4	79.9	78.8	79.1	79.4	79.7	79.2
1978...	79.9	79.5	79.8	79.9	80.9	81.2	80.2	79.2	79.3	78.9	82.1	84.2
1979...	84.8	84.2	84.7	85.0	84.8	85.0	84.6	84.0	83.3	83.6	84.4	83.9
1980...	86.1	86.2	87.5	88.6	86.6	86.2	85.4	85.4	84.8	85.2	86.0	86.6
1981...	86.7	87.3	87.2	87.8	88.8	88.6	89.5	90.9	91.3	90.9	90.4	90.6
1982...	90.4	91.7	91.7	92.4	92.3	94.5	95.4	95.2	95.9	97.8	98.4	96.8
1983...	94.1	93.8	93.9	98.3	99.1	100.0	100.6	101.7	102.9	102.8	102.9	103.3
1984...	103.8	103.1	103.0	103.1	103.6	104.2	105.1	105.4	106.7	107.5	108.7	109.7
1985...	111.6	112.2	113.4	113.6	114.5	114.8	115.0	115.9	116.1	116.2	117.0	117.7
1986...	117.6	116.4	116.0	115.4	115.4	115.7	116.7	116.2	117.6	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

Table E

REAL DOLLAR SUBINDEX: EUROPE

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	90.8	91.0	92.5	93.0	93.4	94.4	94.6	93.9	93.0	92.4	91.6	90.4
1977...	89.8	90.4	90.1	89.4	89.1	89.0	88.4	88.8	89.1	87.6	86.5	84.3
1978...	82.5	81.9	81.4	81.8	84.0	83.5	82.1	80.1	79.4	76.2	78.6	78.1
1979...	76.8	77.4	77.4	78.1	79.1	78.5	75.4	75.9	75.4	75.9	76.1	74.6
1980...	73.7	74.5	78.7	79.1	76.3	75.7	74.4	75.8	75.7	77.1	79.7	82.0
1981...	82.1	87.2	87.2	88.8	93.7	97.6	101.0	103.9	100.0	97.1	95.1	96.0
1982...	97.1	99.7	100.8	101.9	99.0	104.9	107.0	107.6	108.6	110.1	111.6	107.5
1983...	106.7	108.4	109.3	110.0	110.6	113.6	115.2	118.3	118.3	116.4	118.9	121.5
1984...	124.5	121.1	117.0	118.8	122.9	122.8	127.8	129.4	135.2	137.2	133.7	138.4
1985...	142.1	147.0	147.1	136.3	137.2	135.2	128.8	125.0	127.2	119.5	117.4	115.1
1986...	113.1	108.7	105.3	105.0	103.4	104.3	101.6	99.1	98.7	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

Table F

REAL DOLLAR SUBINDEX: WESTERN HEMISPHERE (EXCLUDING CANADA)

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	93.5	92.3	93.1	92.8	92.5	93.0	92.8	92.2	102.7	102.6	105.9	99.6
1977...	98.8	101.6	100.7	99.7	100.3	99.8	99.2	99.4	98.7	98.2	98.5	99.0
1978...	99.7	99.2	99.7	99.6	99.7	100.1	99.4	100.0	99.5	99.3	99.7	99.9
1979...	98.8	99.2	99.1	98.9	99.8	100.1	99.2	98.7	98.2	97.6	97.3	98.5
1980...	98.3	98.1	98.2	97.7	97.4	96.9	95.2	94.5	94.2	93.5	93.0	92.2
1981...	91.3	91.0	90.9	90.6	90.8	91.1	91.3	91.1	91.4	91.5	91.6	91.1
1982...	89.2	93.8	106.8	105.3	104.2	104.6	103.5	120.5	123.9	111.6	109.4	110.6
1983...	115.9	116.8	118.1	118.2	118.4	118.1	117.3	118.0	118.3	118.5	118.2	118.5
1984...	117.5	118.7	125.2	124.5	124.4	123.8	123.4	123.6	123.4	122.8	122.5	121.6
1985...	122.7	122.4	122.5	123.5	124.6	124.6	125.7	132.8	133.3	134.4	134.1	135.7
1986...	136.2	137.5	140.0	140.0	140.6	140.5	142.2	145.2	146.6	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

Table G

REAL DOLLAR SUBINDEX: OTHER 49 COUNTRIES

Year	January	February	March	April	May	June	July	August	September	October	November	December
1976...	80.5	79.3	78.9	78.5	78.0	77.5	77.0	76.6	76.2	75.2	75.5	75.7
1977...	73.2	73.4	72.5	71.7	71.2	70.5	69.9	69.3	69.4	68.9	69.5	69.0
1978...	71.7	71.5	71.2	71.3	71.8	72.3	72.3	72.0	72.0	71.3	71.7	71.4
1979...	71.8	72.1	71.9	71.9	72.4	72.6	72.3	72.5	72.6	73.0	73.4	73.0
1980...	71.9	72.2	73.5	74.0	73.1	72.7	70.7	70.5	70.4	70.3	70.7	71.8
1981...	72.6	73.9	74.4	74.2	76.3	78.5	79.6	80.6	80.3	80.1	79.5	79.7
1982...	82.4	83.4	83.5	84.1	84.0	86.2	86.8	87.0	87.3	87.3	86.8	84.8
1983...	88.7	88.9	89.6	89.9	89.5	90.0	90.8	91.4	92.2	94.2	94.4	94.0
1984...	100.0	99.1	98.0	98.0	98.7	99.8	103.3	104.3	105.8	107.5	107.0	108.8
1985...	109.5	111.2	113.5	112.7	112.7	112.4	110.8	110.6	112.0	110.5	111.3	111.6
1986...	110.1	108.1	106.6	105.2	105.3	108.7	110.6	111.1	110.4	—	—	—

SOURCES OF PRIMARY DATA: Bank of America.
Financial Times (London).
International Monetary Fund.

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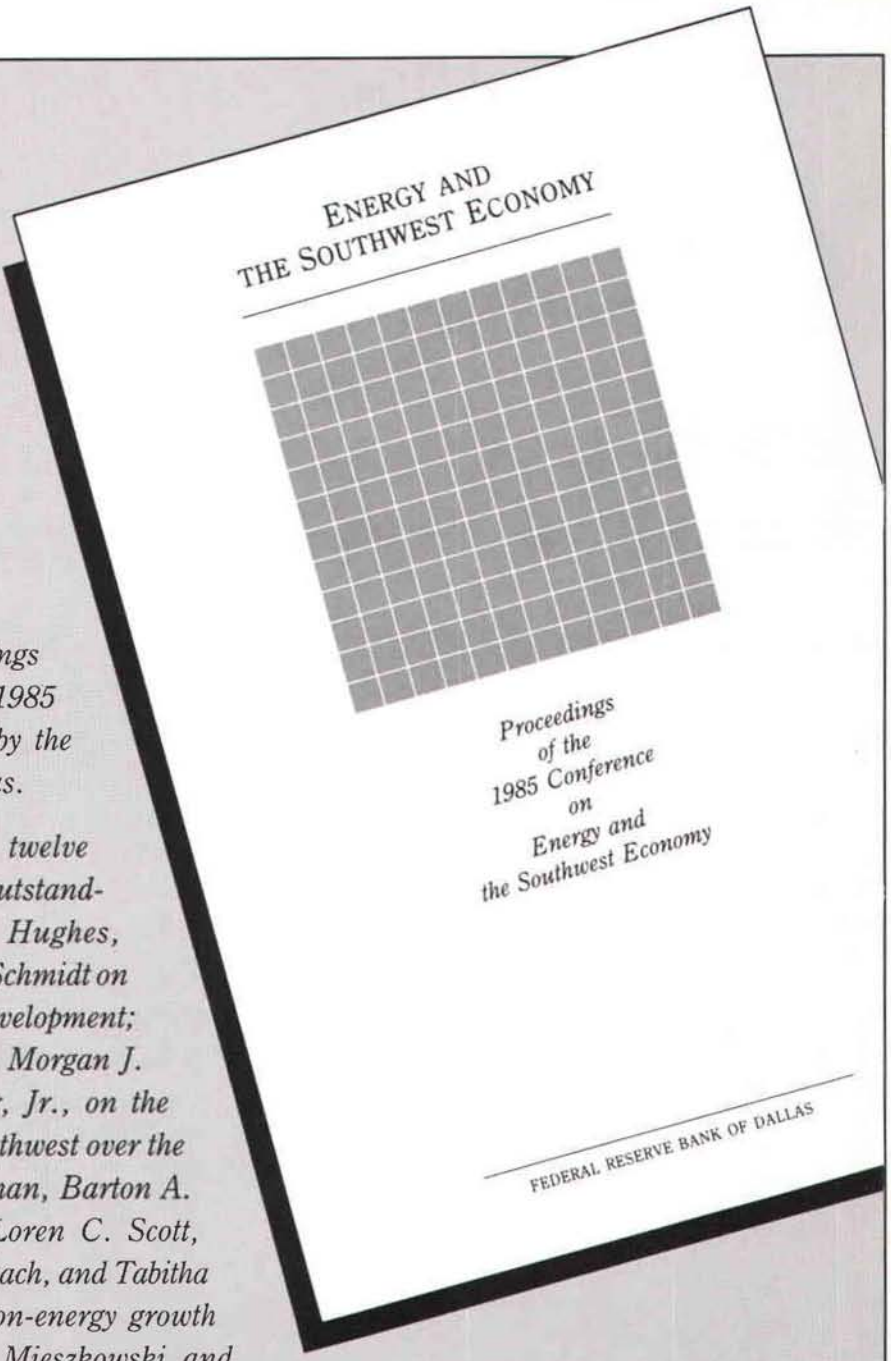

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Bank Problems and Financial Safety Nets

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The recent increase in banking difficulties has attracted widespread attention from industry specialists, scholars, and policymakers. Throughout most of the post-World War II period, the number of failed banks has been low, but recently this experience has changed. Between 1945 and 1979, the United States averaged six bank failures per year. During the last seven years, however, more than 450 banks have failed. This is more than double the 204 bank failures that occurred during the preceding thirty-five years of the postwar period.

An even larger increase has occurred in the number of U.S. banks identified as problem institutions. As shown in Figure 1, the proportion of problem banks in the country has increased steadily from roughly 2 percent of all banks in 1982 to just under 10 percent in 1986.[1] Even though nearly 1,500 banks now are listed as problem institutions, regulators are concerned that the actual number of such institutions may exceed the published total.[2] This suggests that the current relatively high number of bank failures will continue in the foreseeable future.[3]

A number of reasons have been suggested as potential explanations for current banking difficulties. The severity of the last recession seriously weakened the financial condition of a number of bank borrowers. And throughout this recovery, these difficulties have been augmented by continued weakness in the agricultural sector and in some manufacturing sectors of the domestic economy. In addition, during the past four years, the sharp adjustment from a high-inflation environment to a low-inflation environment has increased the real cost of debt repayment. This has been troublesome for both domestic and international borrowers, particularly for those less-developed countries with high debt-servicing requirements. Finally, the sharp decline in oil prices recently has thrust the energy-producing states into recession, thereby further weakening the financial condition of banks in those areas.

These observations have led many to claim that the problem is cyclical. But other observers contend that the problem also has structural elements. A recent study by the New York Federal Reserve Bank supports this latter view.[4] The study found that not all the decline in bank profitability could be explained by cyclical factors. Among the structural factors that others have mentioned are recent legislative changes to deregulate financial services.

Deregulation in conjunction with incentives provided by the existing system of federal deposit guarantees is a source of concern.[5] It is widely recognized that the current system of federal deposit guarantees—including fixed-rate pricing and the manner in which the Federal Deposit Insurance Corporation settles failed banks—provides a subsidy to risk taking. The amount of risk incurred by U.S. banks is thus

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greater than it would be in the absence of such subsidies. This occurs partly because deposit guarantees have reduced incentives for bank depositors themselves to monitor the risk exposure of the banks in which they place funds. This, in turn, has reduced restraints against risk taking that normally would be imposed on banks by their depositors. Finally, the large depositors of large banks have received greater protection than have the large depositors of small banks. As a result, large banks have received a greater subsidy to risk taking than have small banks, and the constraints imposed against risk taking by large-bank depositors are thus potentially less binding.[6]

Implications of each of these issues have been examined in this study by comparing problem and nonproblem banks on the basis of exposure to risk and funding costs. For this study, banks were classed as problem banks if they had developed serious earnings problems, while those considered to be nonproblem banks had not experienced such problems.

The purpose of the present study has been twofold: first, to determine whether differences in risk decision making influenced the probability of a bank entering the problem category; and, second, to see whether differences in the cost of funds at the problem and the nonproblem banks provided early warning signals to the bank managers regarding exposure to risk.

Differences according to bank size also were examined by disaggregating the study's sample of banks into small, medium-sized, and large categories. Because the data on the FDIC list of problem banks are not available to the public, it was necessary to develop a sample of problem banks for the present study. All U.S. banks that filed a Report of Condition at the end of 1978 were examined. For the purpose of the analysis, those identified as the *problem banks* were defined to include those banks reporting *four or more* quarters of negative income during the 1982-84 sample period. The *nonproblem banks*, therefore, were defined to include those banks reporting *fewer than four* quarters of negative income during the 1982-84 sample period. The analysis made direct comparisons of risk exposure and funding costs at the problem and nonproblem banks. All banks in the sample reported positive income throughout 1980 and 1981.

In the analysis, risk management was addressed by comparing the asset-and-liability portfolios of problem banks with those of nonproblem banks. Comparisons were made using balance sheet data from 1981—one year prior to the emergence of negative earnings at the problem banks. The variables investigated were those that bank managers control directly with portfolio decisions. This enabled the study to determine whether the managers of the problem banks chose more aggressive risk strategies in the period prior to the emergence of earnings problems at their respective institutions. The second issue—regarding the effectiveness of the bank certificates of deposit market as a constraint against risk taking—was examined by investigating differences in the cost of funds at the same sample of problem and nonproblem banks.

The results of the study reported in this article support the view that the incentive structure that currently encourages U.S. banks to increase their exposure to risk needs more attention. In the study, significant differences were identified between the risk decisions made at problem and nonproblem banks, with problem banks exhibiting greater exposure to risk. The differences, however, were less pronounced at the large banks examined.

Similar findings regarding differences in funding costs emerged in the study. Statistically significant risk premiums were identified in the samples of the small and the medium-sized banks, but not in that of the large banks. Even at the smaller institutions, however, these differences did not emerge until *after* negative earnings had been reported. This suggests that the bank CD market does not provide warnings regarding exposure to risk early enough to induce banks to alter their risk strategies prior to the development of serious problems.

This result does not imply, however, that the bank deposit market is an inefficient mechanism for restraining risk taking. Under the current institutional arrangements, pricing signals in the bank CD market reflect the impact of federal deposit guarantees. Such guarantees have removed incentives for depositors to monitor a bank's risk exposure unless the probability of bank failure appears high. This situation suggests that the impact of federal deposit guarantees on incentives to incur risk should be examined in any effort that is made to reduce the number of banks with serious earnings problems.

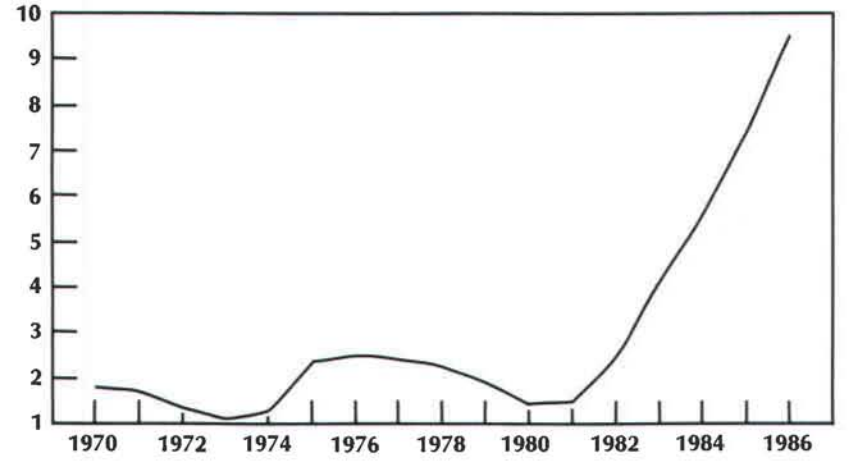
Overview of current bank problems: cyclical or structural basis

The current level of bank problems is high by historical standards.[7] Although the bank failure rate from 1864 through 1986 (see Figure 2) shows that the current rate of bank failures does not approach the rate of failures in the Great Depression, it is high relative to other periods. During the three banking crises between 1930 and 1933, there were 9,106 banks that failed. As highlighted in Figure 2, the average rate of bank failures during that four-year period was 12.6 percent. But in 1933, during the peak of the banking crisis, 4,004 banks failed—resulting in a failure rate of 27.1

Figure 1

Problem Bank Rate

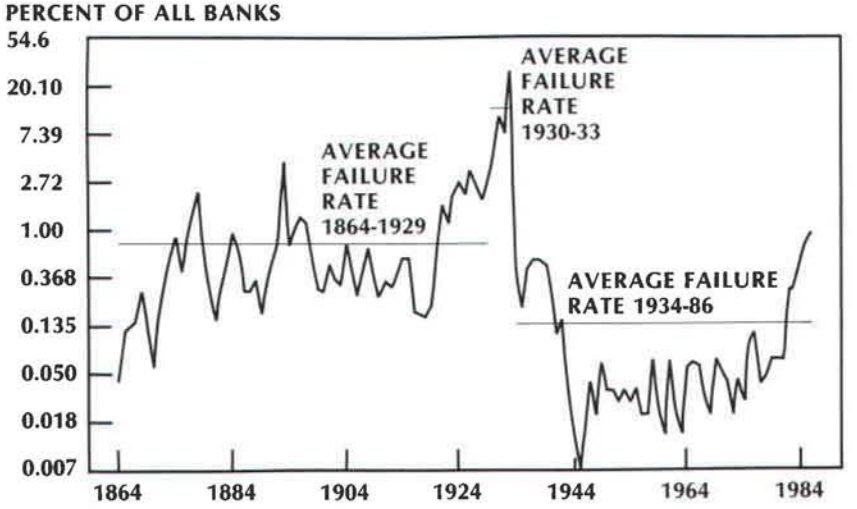
(Includes Commercial and Mutual Savings Banks)



SOURCES OF PRIMARY DATA: Board of Governors, Federal Reserve System.
Federal Deposit Insurance Corporation.

Figure 2

Bank Failure Rate



NOTE: Vertical axis scale is logarithmic.

SOURCES OF PRIMARY DATA: Board of Governors, Federal Reserve System.
Federal Deposit Insurance Corporation.
U.S. Bureau of the Census.

percent. In contrast, during 1985 and 1986, the bank failure rate averaged 0.84 percent.[8]

Although the recent failure rate is considerably below the failure rate for 1930-33, it is above the average rate of bank failures that occurred both prior to and after the banking crisis in the Great Depression. From 1864 through 1929, the annual rate of bank failures averaged 0.77 percent. After 1934—the year that federal deposit insurance was introduced—the average annual rate of bank failures dropped to 0.11 percent. If these two periods are consolidated, the average annual rate of U.S. bank failures is 0.47 percent, just over one-half of the failure rate in 1986.

Hence, the current rate of bank failures is not only high compared to the relatively low rate of bank failures since 1934, it is also higher than the average rate of bank failures prior to the banking crisis in the Great Depression. This is particularly alarming given that banks today are protected by federal deposit guarantees. Prior to 1934, bank suspensions and some subsequent failures did result from deposit runs.[9] The high proportion of banks listed as problem institutions indicates that the number of failures today would likely be higher than the recorded number if banks were not protected with federal deposit guarantees.[10]

As noted earlier, the recent rise in banking problems has heightened concerns about the strength of the banking system. The current experience contrasts sharply with other periods of economic recovery. In the past, weakness in the banking sector declined as recovery proceeded. During the present recovery, however, conditions in the banking sector have deteriorated, even though the overall economy has been growing and interest rates have been declining. This divergence has raised questions about the expected duration of current banking problems.

Are these difficulties primarily the result of short-term cyclical factors that will dissipate as long as the economic recovery continues? Or do current difficulties reflect structural problems that have longer-term implications for the banking industry?

These issues were addressed in a recent staff study at the Federal Reserve Bank of New York cited earlier on trends in bank profitability.[11] Although major differences exist among individual banks, the study identifies that U.S. bank profits have declined during this decade and that the decline appears to reflect both cyclical and structural forces. Regression equations using business cycle variables are able to explain a significant fraction of the recent variation in bank profits. But the actual profit decline is greater than can be explained by cyclical variations.[12]

Two of the findings in the New York study are particularly interesting. First, the study notes that the impact of the change in the interest rate environment on recent bank profitability appears to have been cyclical. The uptrend in interest rates through 1981 reduced bank profitability because banks as a group had more short-term liabilities than short-term assets. But since 1981, the decline in interest rates has increased bank profits.[13]

A second important set of findings relates to the sharp increase in provisions for loan losses that banks have been required to make in the recent past. The study indicates that these increased provisions for loan losses were the key determinant of declining bank profits during 1980-85.[14] And different from the impact of changing interest rates on bank profits, these increases in loan-loss provisions have seemed to reflect both cyclical and structural factors.[15]

The cyclical forces include the decline in real GNP early in the decade, the adjustment in inflation and interest rates, and an unexpected weakness in the agricultural and energy-dependent sectors of the economy as well as in some sectors of manufacturing. These factors were able to explain a significant portion—but not all—of the increased loan-loss provisions required of U.S. banks.[16] This evidence suggests that the decline in bank profitability also appears to reflect longer-term structural factors.

Regarding structural changes, the New York study notes that the decline in demand for bank credit by highly rated borrowers may have left many banks with lower quality credits.[17] But as long as banks accurately reflect the higher credit risk in loan-pricing terms, this would not necessarily result in a decline in profitability. Noting this point, the New York staff study suggests that the recent decline in bank profitability probably reflects a miscalculation of the deterioration in the quality of their loan credits rather than a deliberate change in portfolio strategy toward loans with higher expected losses.[18] While this interpretation is plausible, the results of the present study indicate that managers of problem banks did indeed choose higher risk profiles. Those banks in which the decline in earnings was the most pronounced do appear to have pursued more aggressive risk strategies. Nonmarket incentives to incur risk offer an alternative explanation for the recent rise in bank loan problems.

Impact of risk decisions on bank problems

The preceding section establishes that the high level of current banking difficulties seems to reflect both cyclical and structural forces. This raises legitimate concerns about the long-run nature of the present banking problems. The results of the study reported in this section identify that those banks in the sample that developed serious earnings prob-

lems during the period examined had exhibited a greater willingness to incur risk.

The examination in this study of how risk decisions affect which banks developed earnings problems has followed the approach taken by Eugene Nelson White in his study of banking difficulties during the Great Depression.[19] White compared failed and nonfailed banks during 1933 and for several years during the 1920s. He examined differences in key financial ratios and the quality of bond holdings in these banks. White used these results to ascertain whether managerial decisions to incur risk were a significant factor in bank failures both during and before the Great Depression.

White's approach has been adapted to the current environment by adjusting for changes that have occurred in portfolio management since the 1930s. In the present study, bank managers were assumed to choose the riskiness of their respective bank portfolios on the basis of risk/reward trade-offs. These choices would reflect the opportunities facing managers and the constraints on their behavior. An increased willingness to incur risk also increases the variability of the bank's income stream. The probability of failure is thus increased when more risk is incurred. Explanatory variables depicting key asset-liability decisions made by bank managers were calculated from available balance sheet information. Problem banks were then compared with nonproblem banks.

Moreover, because the current system of financial safety nets provides greater protection to large banks, the subsidy to risk taking is larger at large banks than it is at smaller banks. It was thus of interest in this study to determine whether differences between the risk exposure at problem and nonproblem banks varied according to bank size.

Overview of the estimation technique

The impact of risk decisions on current banking difficulties was estimated by employing a qualitative-response model. The equation was estimated using the probit technique. The dependent variable was assigned a value of one for problem banks and zero for nonproblem banks.

A positive coefficient on a financial variable indicates that the higher the value of the variable, the greater the probability that the bank will become a problem institution. Alternatively, a negative sign indicates that the greater the value of the variable, the lower the probability that it will become a problem bank.

The financial ratios included in the estimated equation are proxies for risk-decision variables that are subject to direct management control. Included were the following variables:

1. Capital to assets
2. Loans to assets
3. Treasury securities to assets
4. Core deposits to liabilities
5. Purchased funds to liabilities

Two of these variables—loans to assets and U.S. Treasury securities to assets—served as proxies for the bank's exposure to asset risk. Loans, as a class of assets, generally are considered to be the riskiest that banks hold.[20] The expected sign on this variable is positive. U.S. Treasury securities, on the other hand, traditionally are viewed as interest-bearing assets without default risk, providing banks with liquidity as well as safety of income. Hence, the expected sign for them is negative.

The capital-to-assets ratio was included to measure capital adequacy. The expected sign on this ratio is negative. But unlike the other variables included in the equation, the capital-to-assets variable cannot be viewed solely as the outcome of managerial choice. Regulatory agencies specify acceptable capital ratios for banks and then pressure banks to maintain adequate ratios. A general tendency has developed for banks to hold the minimum acceptable level of capital. Differences between problem and nonproblem banks thus are likely to be small.

The remaining two variables—core deposits to liabilities and purchased funds to liabilities—were included to measure vulnerability to deposit outflows. Core deposits include demand deposits plus saving deposits. Purchased funds include large certificates of deposit, net federal funds purchased, plus borrowings from the Federal Reserve.

The liability instruments included in the purchased-funds variable are wholesale instruments that tend to be more responsive to changes in interest rates. Hence, they may provide a less stable source of funds to banks than do the smaller retail deposits included in the core-deposit variable. The expected sign on the core-deposit variable is negative, while that on the purchased-funds variable is positive.

Overview of the empirical results

Balance sheet data reported quarterly to the FDIC in the Consolidated Report of Condition (bank Call Report data) were used to calculate the financial ratios. These data were taken from the December 1981 reports. The choice of these data reflected the assumption that differences in balance sheet variables of problem banks would be evident in the year prior to the emergence of negative income.[21]

Table 1
DETERMINANTS OF PROBLEM BANKS: PROBIT ESTIMATES[1]

Variable	All banks
Intercept	-3.693*
	(0.266)
Total capital to assets	1.222
	(1.058)
Loans to assets	2.727*
	(0.326)
Treasury securities to assets	-0.726
	(0.504)
Core deposits to liabilities	-0.655*
	(0.277)
Purchased funds to liabilities	1.338*
	(0.209)
Likelihood-ratio test statistic	190.1*
Degrees of freedom	5

NOTE: The numbers in parentheses are estimated asymptotic standard errors.
* Significant at the .01 level.
1 Problem banks are defined as those banks with four or more quarters of negative income during the three-year period from 1982 through 1984; the first quarter of negative income occurred during 1982, and all banks in the sample had positive income throughout 1980 and 1981.
SOURCE OF PRIMARY DATA: Federal Deposit Insurance Corporation, Bank Report of Condition.

Table 2
SAMPLE MEANS FOR PROBLEM AND NONPROBLEM BANKS[1]

	All banks	
Variable	Problem	Non-problem
Capital to assets	0.0889	0.9210
Loans to assets	0.6428	0.5665
Treasury securities to assets	0.0671	0.1059
Core deposits to liabilities	0.4051	0.4341
Purchased funds to liabilities	0.1979	0.1280
Sample size	241	12,279

1 Problem banks are defined as those banks with four or more quarters of negative income during the three-year period from 1982 through 1984; the first quarter of negative income occurred during 1982, and all banks in the sample had positive income throughout 1980 and 1981.
SOURCE OF PRIMARY DATA: Federal Deposit Insurance Corporation, Bank Report of Condition.

The maximum likelihood estimates of the relationship between a bank's 1981 financial ratios and the probability that the bank would be classified later as a problem institution are reported in Table 1 and the variable means in Table 2. As indicated by the likelihood-ratio test, the equation was able to explain the variation between the problem and the nonproblem banks at the 1-percent level.[22] Three of the five explanatory variables included in the equation had the expected sign and were found to be statistically significant. The results thus indicate that both the increased exposure to default risk and a heavy reliance on interest-sensitive sources of funds are important factors in determining differences between the problem and the nonproblem banks. In addition, the problem banks examined in this study relied significantly less on core deposits to fund their operations. The remaining two variables included in the specification—Treasury securities to assets and capital to assets—did not emerge as significant determinants of problem banks. But differences in the mean values of all five of the explanatory variables were in the expected direction.

To determine whether differences in the risk decisions at the problem and the nonproblem banks were influenced by size, the sample was separated into three bank-size categories.[23] These were based on asset size in 1981: small (less than $100 million), medium-sized ($100 to $500 million), and large (greater than $500 million). Maximum likelihood estimates of the probit equations for these three size categories are reported in Table 3 and variable means in Table 4.

The results indicated that after adjustments for bank size, the equation was less able to distinguish between the problem and the nonproblem banks in the medium-sized and large categories. The results for the small banks, however, were similar to those for the entire sample. The similarity of these results is not surprising because 88 percent of the problem banks in the consolidated sample were small banks and 86 percent of the nonproblem banks likewise were small banks. The results for the two larger categories

Table 3
DETERMINANTS OF PROBLEM BANKS BY BANK SIZE: PROBIT ESTIMATES[1]

Variable	Bank size, by assets		
	Small (Less than $100 million)	Medium-sized ($100 to $500 million)	Large (Greater than $500 million)
Intercept	-3.759*	-1.594	-1.551
	(0.286)	(1.130)	(2.082)
Total capital to assets	1.154	-11.922+	1.209
	(1.230)	(7.093)	(10.870)
Loans to assets	2.696*	1.236	4.119+
	(0.347)	(1.135)	(2.539)
Treasury securities to assets	-0.713	-1.919	-3.565
	(0.522)	(2.199)	(6.046)
Core deposits to liabilities	-0.579**	-1.332	-4.902+
	(0.294)	(1.163)	(2.789)
Purchased funds to liabilities	1.981*	1.254+	-2.684+
	(0.263)	(0.704)	(1.623)
Likelihood-ratio test statistic	189.8*	21.7*	7.67
Degrees of freedom	5	5	5

*Significant at the .01 level.
**Significant at the .05 level.
+Significant at the .10 level.
1. Problem banks are defined as those banks with four or more quarters of negative income during the three-year period from 1982 through 1984; the first quarter of negative income occurred during 1982, and all banks in the sample had positive income throughout 1980 and 1981.
SOURCE OF PRIMARY DATA: Federal Deposit Insurance Corporation, Bank Report of Condition.

of banks, however, indicate that it is more difficult—using balance sheet ratios—to differentiate between risk decisions made at large problem and nonproblem banks.

The likelihood-ratio test statistics indicate that the estimated equation was able to explain differences between the small and the medium-sized problem and nonproblem banks at the 1-percent confidence level. The explanatory power of the equation estimated with the sample of the large banks, however, was not statistically significant. For the small-bank sample, the same three financial ratios as those identified in the consolidated sample were significant—loans to assets, core deposits to liabilities, and purchased funds to liabilities. Two variables—purchased funds to liabilities, and capital to assets—were of the expected sign and significant at the 10-percent level in the equation estimated for the medium-sized banks. For the large-bank sample, three of the variables were significant at the 10-percent level—loans to assets, core deposits to liabilities, and purchased funds to liabilities. But the purchased funds-to-liabilities variable was not of the expected sign.

Differences in the sample means at the problem and the nonproblem banks in all three of the size categories were in the expected direction. A comparison of these means also indicated that for four of the five variables the level of risk

Table 4

SAMPLE MEANS FOR PROBLEM AND NONPROBLEM BANKS, BY BANK SIZE[1]

	Bank size, by assets					
	Small (Less than $100 million)		Medium-sized ($100 to $500 million)		Large (Greater than $500 million)	
Variable	Problem	Non-problem	Problem	Non-problem	Problem	Non-problem
Capital to assets	0.0943	0.9555	0.0727	0.8044	0.0650	0.0675
Loans to assets	0.6455	0.5659	0.6204	0.5705	0.6316	0.5725
Treasury securities to assets	0.0689	0.1102	0.0612	0.0817	0.0372	0.0657
Core deposits to liabilities	0.4078	0.4338	0.3929	0.4437	0.3584	0.4032
Purchased funds to liabilities	0.1785	0.1098	0.3267	0.2169	0.3803	0.3668
Sample size	212	10,623	22	1,313	7	343

1. Problem banks are defined as those banks with four or more quarters of negative income during the three-year period from 1982 through 1984; the first quarter of negative income occurred during 1982, and all banks in the sample had positive income throughout 1980 and 1981.

SOURCE OF PRIMARY DATA: Federal Deposit Insurance Corporation, Bank Report of Condition.

at the large banks in the nonproblem sample was higher than that at both the problem and the nonproblem small banks. Only the mean of the loan-to-asset variable was lower at the nonproblem large banks. This, however, was an important exception because exposure to default risk is the most important factor in the increase in banking difficulties.

The lower explanatory power of the equation estimated with the samples of the large banks in part reflected the smaller sample size for these larger banks. An experiment was conducted to determine whether the sample-size differences accounted for all the variations in explanatory power. The explanatory power of the small-bank equation did decline after the sample size was reduced to the same number of observations as for the sample of the problem and nonproblem large banks, but the small-bank equation still outperformed the equation estimated for the large-bank category.[24] This could indicate merely that the equation was not specified appropriately to determine differences in risk decisions at the large problem and nonproblem banks. Alternatively, however, the reduced ability to identify significant differences between the portfolio decisions made at these problem and nonproblem banks could foretell the emergence of problems at other banks in the large-bank category.

Recent information released by the FDIC on the size of banks included in its problem-bank list supports this interpretation.[25] Although the FDIC does not publish data on size of banks included in its problem-bank list, L. William Seidman, Chairman of the FDIC, noted in a press conference in September 1986 that 37 banks with assets of $500 million or more were listed as problem institutions. That compares to the 7 large banks that met the present study's definition of problem banks for the 1982-84 period covered. Hence, a number of large banks included in the nonproblem-bank sample in this study were cited by the FDIC in 1986 as problem banks. Smaller differences between portfolio decisions made at these large banks and the 7 large banks that met the definition of problem banks for this study may have reduced the explanatory power of the large-bank equation.

The findings developed in this study support the view that the decisions to incur risk have contributed to the recent rise in banking problems. Decisions regarding risk/reward trade-offs reflect incentives that bank managers face. But the incentive mechanism is currently skewed toward greater acceptance of risk by federal deposit guarantees. Concerns about the impact that these risk/reward trade-offs are hav-

ing on bank earnings have revitalized a long-standing debate regarding the effectiveness of regulation and supervision as substitutes for market prices as restraints against excessive risk taking.[26] Under the current institutional structure, pricing differences from the bank deposit market do not offer an advance warning signal to bank managers regarding excessive exposure to risk. Hence, the market pricing mechanism is *not* restraining bank risk taking as normally would be expected. This issue is addressed in the next section of the article.

Assessment of the bank CD market as a restraint to risk taking

Concerns about the recent rise in banking difficulties have revitalized interest in strengthening market pricing restraints to risk taking. In the current environment, federal deposit guarantees have reduced the feedback—and possibly restraints—that otherwise would be supplied by the depositors. The *de facto* 100-percent insurance coverage provided to all bank depositors removes incentives for depositors to require risk premiums on deposits unless serious financial problems emerge. As a result, banks that are more exposed to risk do not pay proportionately higher interest rates on their deposits.

Recent research has shown that risk-related premiums do emerge on bank deposits after serious problems have been identified.[27] The probability of depositors with funds in excess of the $100,000 legal limit on FDIC insurance coverage incurring some financial loss in the event of a bank failure is low, but greater than zero. To avoid such losses, depositors have an incentive to remove uninsured funds from a troubled institution. Banks that experience these withdrawals are required to pay risk premiums on their liabilities in order to maintain adequate funding lines. These premiums, however, have not tended to emerge until after serious problems have been identified—problems sufficiently large to warrant concern about the viability of the institution.[28] In addition, because depositors of the nation's largest banks have received stronger protection against losses than have the depositors of smaller institutions, differences in the cost of funds at problem and nonproblem banks are likely to be smaller and less significant at the large banks.[29] These hypothesized results were tested by examining differences in the marginal cost of funds at the problem and the nonproblem banks using the sample disaggregated by bank size.

The marginal cost of funds was calculated using data on the cost of large CDs—that is, CDs in excess of $100,000. The data on the dollar amount of large CD usage were obtained from the FDIC's Report of Condition. Interest expense data were obtained from the FDIC's Report of Income and Expense.

Table 5
DIFFERENCES IN COST OF FUNDS AT PROBLEM AND NONPROBLEM BANKS[1] (Mean Interest Rate: Large Certificates of Deposit)

	Bank size, by assets		
	Small (Less than $100 million)	Medium-sized ($100 million to $1 billion)	Large (Greater than $1 billion)
Year	Percent		
1981	+0.39	+0.10	+0.36
1982	+0.44+	+1.12*	+0.44
1983	+0.40	+1.18+	+0.52

*Significant at the .01 level.
+ Significant at the .10 level.
1. Problem banks are defined as those banks with four or more quarters of negative income during the three-year period from 1982 through 1984; the first quarter of negative income occurred during 1982, and all banks in the sample had positive income throughout 1980 and 1981.
SOURCES OF PRIMARY DATA: Federal Deposit Insurance Corporation, Bank Report of Condition and Bank Report of Income and Expenses.

Comparative costs of funds at the problem and the nonproblem banks in the sample are reported in Table 5. The following three bank categories based on asset size were used: small (less than $100 million), medium-sized ($100 million to $1 billion), and large (greater than $1 billion). In the development of the data for Table 5, the definitions for the problem and the nonproblem banks were the same as those used in the probit analysis. The definitions for the large and the medium-sized banks were changed to better approximate that asset size of banks whose large deposit holders would tend to receive full protection.[30] Comparisons have been reported for three years: 1981 (one year prior to the emergence of earnings problems), 1982, and 1983.

The results developed from this study indicate that deposit-pricing signals were stronger at the medium-sized banks than at the small or the large banks. But even in that bank-size category, they did not appear to have provided an effective early warning signal to the bank managers.

In all three of the bank-size categories, the problem banks did pay a premium for funds relative to the nonproblem

banks, but none of these premiums was statistically significant in 1981, the year prior to the emergence of negative income for the problem-bank group. In 1982, the first year in which the sample of problem banks reported income losses, the deposit premiums paid by the problem banks were marginally significant (10-percent confidence level) in the small-bank category (assets less than $100 million), and they were highly significant (1-percent confidence level) in the medium-sized bank category (assets of $100 million to $1 billion). The premium paid by banks in the large-bank category (assets greater than $1 billion) was of the correct sign, but it was not statistically significant. Although the size of the premium at the large banks was equivalent to that at the small banks, it was significantly smaller than that at the medium-sized banks.

The results for 1983 are similar to the 1982 results, but the differences between the problem and the nonproblem banks in the two smaller size categories were not as strong. This probably reflects a deficiency in the definition for problem banks that was developed for this study. By 1983, although some of the banks included in the nonproblem-bank sample did report negative income, they were included in the nonproblem sample if less than four quarters of negative income were reported.

The differences identified in the course of the study between the large and the medium-sized banks are consistent with the view that the large depositors of the nation's largest banks are aware that they are less likely to incur financial loss as a result of failure than are the large depositors of the smaller banks. In none of the three years examined did statistically significant risk premiums emerge at the problem banks in the large-bank category. In contrast, the results for the study's medium-sized banks indicated that by 1982, the first year in which the problem banks reported negative income, statistically significant risk premiums did emerge on large CDs held at these problem banks. These results thus reflect the perception that the holders of uninsured deposits in banks with less than $1 billion in assets face a positive, albeit low, probability of incurring financial loss in the event their bank fails.

The results on risk premiums for the small-bank category, however, provided only weak evidence of differences between pricing restraints against risk taking at large and small banks. Marginally significant premiums on deposits at the small problem banks did emerge in 1982, but for 1983, the differentials were not statistically different from zero. Again, however, these weak results may reflect a more limited use of uninsured deposits at these small banks that would reduce the potential for risk premiums to emerge at the problem institutions.[31]

Conclusion

The results of the statistical analysis for this study indicate that significant differences can be identified between the risk decisions made by the managers of the problem and the nonproblem banks in the small and medium-sized bank categories. In both of these size categories, the managers of the sample banks that developed problems after 1981 exhibited a greater willingness to accept risk during 1981. At the larger banks in the sample, on the other hand, the differences between management decisions to incur risk at the problem and the nonproblem large banks were less pronounced. Moreover, in the study, the exposure to risk at the large banks was found to be greater than that for the smaller banks.

Managers of larger banks generally are viewed to be more capable of managing risk than are managers of smaller banks. Hence, a higher level of risk exposure at the nation's largest banks was expected in the study. But relative to historical standards, the recent rise in failed and problem banks has been high in all categories—at small, medium-sized, and large banks. In contrast, prior to the 1980s, problems at the largest banks have appeared less prevalent.[32] The relatively high exposure to risk identified at the large banks in the course of this study—together with the large number of other sizes of banks that are experiencing serious difficulties—may suggest that U.S. banks are less able to withstand unanticipated shocks that might occur in the future.

The increased exposure to risk by U.S. banks in part reflects the removal of certain market constraints against risk taking. The analysis of marginal funding costs at the problem and the nonproblem banks in this study indicated that the bank deposit market probably does not provide an effective advance warning signal to bank managers regarding excessive exposure to risk. This is not to say the managers of the problem banks in the study received no information regarding the potential of facing severe earnings problems. The sample of the problem banks in all size categories did have higher marginal funding costs. But the differences between these costs were not statistically significant. Hence, it is not likely that these signals were sufficiently strong to induce the managers to alter their risk strategies before serious earnings problems developed.

The removal of regulatory restraints on the one hand while failing on the other to reintroduce market pricing signals in their place has resulted in a greater reliance on the regulatory examination process to monitor bank operations. The distressing rise in both the number and the rate of failed and problem banks raises questions regarding the effectiveness of such extensive reliance on bank supervision.

A number of proposals have been suggested as a means of increasing market discipline on bank risk taking. The most widely debated alternatives include the implementation of risk-based premiums on deposit insurance, the imposition of risk-based capital requirements, the increased disclosure of examination reports on bank performance, and a more extensive use of deposit payoffs to settle failed banks.[33] In addition, some analysts have recommended the benefits of substituting a private system of deposit insurance for the current system of federal deposit guarantees.[34] Although a complete analysis of the relative merits of these alternative proposals is beyond the scope of this paper, the review of current difficulties presented here does underscore the need to reexamine the incentive structure that currently motivates U.S. banks to incur risk.

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1. A bank is defined as a problem bank if it receives a CAMEL rating of either a 4 or a 5 on the examination report it receives from bank regulators. The CAMEL rating includes the regulatory examiner's assessment of a bank's performance on the basis of five categories: capital adequacy, assets, management, earnings, and liquidity. Banks are given CAMEL ratings on a scale of 1 to 5 on each of these five performance categories, and the banks examined are also assigned a composite rating. Banks with composite CAMEL ratings of a 4 or a 5 are viewed as having enough deficiencies to be identified as problem institutions. While being included in this problem-bank list does not necessarily result in a bank failing, the probability of failure is higher among such banks.

2. Resource constraints have forced both state and federal regulatory agencies to concentrate their bank examiners at institutions where serious problems have been identified already. This has lengthened the interval between examinations at other institutions for which problems have not yet been identified. The potential for underestimating the actual number of problem banks thus has increased.

3. A regression of the number of bank failures on the number of problem banks in the sample indicated that an increase of ten problem banks was associated with an increase of one failure. Hence, the current number of problem banks was consistent with 150 bank failures per year. The equation explained 96 percent of the variation in failures. Alternative specifications—including a variety of lagged structures—did not improve the explanatory power of the regression equation.

4. *Recent Trends in Commercial Bank Profitability: A Staff Study* (New York: Federal Reserve Bank of New York, 1986).

5. For a thorough review of the most widely accepted arguments on this issue, see George J. Benston, Robert A. Eisenbeis, Paul M. Horvitz, Edward J. Kane, and George C. Kaufman, *Perspectives on Safe & Sound Banking: Past, Present, and Future*, A Study Commissioned by the American Bankers Association (Cambridge, Mass.: The MIT Press, 1986). For an additional discussion of the causes of recent bank problems, see John Bovenzi and Lynn Nejezchleb, "Bank Failures: Why Are There So Many?" *Issues in Bank Regulation* 8 (Winter 1985): 54-68; George J. Benston, "Deposit Insurance and Bank Failures," *Economic Review*, Federal Reserve Bank of Atlanta, March 1983, 4-17; Richard L. Peterson and William L. Scott, "Major Causes of Bank Failures," *Proceedings*, A Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, 1-3 May 1985 (Chicago, 1985), 166-83; and Edward J. Kane, *The Gathering Crisis in Federal Deposit Insurance* (Cambridge, Mass.: The MIT Press, 1985).

6. For a more thorough discussion of this point, see Paul M. Horvitz, "Failures of Large Banks: Implications for Banking Supervision and Deposit Insurance," *Journal of Financial and Quantitative Analysis* 10 (November 1975): 589-601; Barbara A. Bennett, "Bank Regulation and Deposit Insurance: Controlling the FDIC's Losses," *Economic Review*, Federal Reserve Bank of San Francisco, Spring 1984, 16-30; and Eugenie D. Short, "FDIC Settlement Practices and the Size of Failed Banks," *Economic Review*, Federal Reserve Bank of Dallas, March 1985, 12-20.

7. Annual data on the number of failures from 1864 to 1933 were obtained from U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970, Part 2*, Bicentennial Edition (Washington, D.C.: Government Printing Office, 1975). Comparable data for 1934 to 1985 were obtained from the Federal Deposit Insurance Corporation, *1985 Annual Report* (Washington, D.C., 1986), Table 125, 68. Data for 1986 on banks closed because of financial difficulty were obtained directly from the FDIC. Annual data on the number of banks from 1864 to 1970 were obtained from U.S. Bureau of the Census, *Historical Statistics, Colonial Times to 1970*. Comparable data for the period 1971 to 1986 were obtained from the FDIC's Consolidated Report of Condition (bank Call Report data).

8. This was calculated based on actual failures in 1985 reported in the FDIC's *1985 Annual Report*, and the data for the 1986 failures were obtained directly from the FDIC.

9. The term "suspension" here refers to banks that were closed at least temporarily by the regulating agencies. Some of these banks later reopened. In contrast, the phrase "suspension of payments" is used to designate the refusal of banks to convert deposits to currency on demand. For a further explanation of this terminological difference, see Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867-1960*, A Study by the National Bureau of Economic Research, New York (Princeton, N.J.: Princeton University Press, 1971 [1963]), 110 n. 32.

10. This is not to say that in the absence of deposit insurance every problem bank would fail. Those banks that were sound would be able to obtain funds either directly from the Federal Reserve discount window or in the open market.

11. *Recent Trends in Commercial Bank Profitability*.

12. Richard G. Davis, "Conclusion," in *Recent Trends in Commercial Bank Profitability: A Staff Study* (New York: Federal Reserve Bank of New York, September 1986), 373.

13. Paul Bennett, "The Effects of Changes in the Interest Rate Environment on Large Bank Earnings," in *Recent Trends in Commercial Bank Profitability: A Staff Study* (New York: Federal Reserve Bank of New York, September 1986), 115-39; and Davis, "Conclusion," 374.

14. S. Wayne Passmore and Betsy B. White, "The Effect of Loan Losses on Bank Profitability," in *Recent Trends in Commercial Bank Profitability: A Staff Study* (New York: Federal Reserve Bank of New York, September 1986), 141-58; and Davis, "Conclusion," 374-78. This finding is also supported by a recent study on banking difficulties by Arnold Kling showing that the dominant factor in determining whether a bank had positive

or negative earnings was the change in its loan-loss provision, not change in funding costs. His document, "The Banking Crisis from a Macroeconomic Perspective," is an unpublished working paper, Federal Reserve Board of Governors, Federal Reserve System, September 1986.

15. Davis, "Conclusion," 375.

16. Davis, "Conclusion," 378.

17. Davis, "Conclusion," 375.

18. Davis, "Conclusion," 375.

19. See Eugene Nelson White, "A Reinterpretation of the Banking Crisis of 1930," *Journal of Economic History* 44 (March 1984): 119-38.

20. The loan-to-asset ratio was constructed to include gross loans plus federal funds sold and securities purchased under agreement to resell, all divided by total assets.

21. Year-end Call Report data were used in all cases to avoid the introduction of seasonality into the data. Mutual savings banks were excluded from the data set because of lack of data comparability.

22. The results are similar to those obtained for the determinants of bank failures in a prior study. See Eugenie D. Short, Gerald P. O'Driscoll, Jr., and Franklin D. Berger, "Recent Bank Failures: Determinants and Consequences," in *Proceedings*, A Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, 1-3 May 1985 (Chicago, 1985), 150-65.

23. The hypothesis that banks in the small, medium-sized, and large categories shared a common equation was tested using the likelihood-ratio test. The value of the test statistic was 29.8, well above the 5-percent critical value of 21.0 from the chi-square distribution with 12 degrees of freedom. Based on this analysis, the hypothesis that a single equation better fit the sample was rejected, and individual equations were estimated for the three bank-size categories.

24. In an effort to measure the extent of the effect of sample size, the equation was estimated 50 times, using reduced numbers of randomly drawn observations on the problem and the nonproblem small banks equal to the numbers of observations available for the problem and the nonproblem banks in the medium-sized and large categories. Using a sample comparable in size to that for the medium-sized banks, the explanatory power of the equation for the small banks was still higher in 64 percent of the cases than that of the equation when applied to the medium-sized banks. Using a sample comparable in size to that for the large banks, in 70 percent of the cases the explanatory power of the equation estimated with the small banks was higher than the explanatory power of the equation estimated with the large banks.

25. The FDIC Chairman, L. William Seidman, indicated in a recent news conference that 37 institutions with assets of $500 million or more were included in the agency's problem-bank list. This was reported by Kathleen Day, "7.6% of Largest U.S. Banks In Trouble, FDIC Reports," *The Washington Post*, 13 September 1986.

26. For further discussion of the relationship between deposit insurance and banking problems in a partially deregulated financial environment, see John H. Kareken, "The First Step in Bank Deregulation: What About the FDIC?" *The American Economic Review* 73 (May 1983, Papers and Proceedings, 1982): 198-203; Mark J. Flannery, "Deposit Insurance Creates a Need for Bank Regulation," *Business Review*, Federal Reserve Bank of Philadelphia, January/February 1982, 17-27; and Eugenie D. Short and Gerald P. O'Driscoll, Jr., "Deposit Insurance and Financial Stability," *Business Forum* 8 (Summer 1983): 10-13.

27. See Timothy H. Hannan and Gerald A. Hanweck, "Bank Insolvency Risk and the Market for Large Certificates of Deposit," Working Paper in Banking, Finance, and Microeconomics no. 86-1, Financial Structure Section, Division of Research and Statistics, Board of Governors, Federal Reserve System, April 1986; and Herbert Baer and Elijah Brewer, "Uninsured deposits as a source of market discipline: Some new evidence," *Economic Perspectives*, Federal Reserve Bank of Chicago, September/October 1986, 23-31.

28. For a discussion of recent behavior in the money market, see Alan E. Grunewald and Alex J. Pollock, "Money Managers and Bank Liquidity," *Proceedings*, A Conference on Bank Structure and Competition, Federal Reserve Bank of Chicago, 1-3 May 1985 (Chicago, 1985), 563-75.

29. In the recent past, the FDIC has used modified payouts to settle small failed banks, but the uninsured depositors of the nation's largest banks have tended to receive full guarantees. The distinction between the settlement practices used for large and for small banks was particularly pronounced in the case of Continental Illinois. For that bank, full guarantees were given to *all* general creditors prior to failure.

30. It is assumed here that bank depositors perceive that the probability of incurring financial loss is lower at banks with assets greater than $1 billion than at smaller banks. While this size cutoff is somewhat arbitrary, it is generally consistent with the policy actions used during the recent past for settling failed banks.

31. For data on the trends in reliance on uninsured deposits by bank size, see Baer and Brewer, "Uninsured deposits as a source of market discipline," 24.

32. For a discussion of the increase in difficulties at large banks, see Short, "FDIC Settlement Practices and the Size of Failed Banks."

33. For a comprehensive overview of the main arguments raised about those proposals, see Benston et al., *Perspectives on Safe & Sound Banking: Past, Present, and Future*; U.S. General Accounting Office, *Deposit Insurance: Analysis of Reform Proposals*, Staff Study, vols. 1 and 2 (Washington, D.C., 30 September 1986); and Federal Deposit Insurance Corporation, *Deposit Insurance in a Changing Environment*, A study of the current system of deposit insurance pursuant to Section 712 of the Garn-St Germain Depository Institutions Act of 1982, submitted to the United States Congress by the Federal Deposit Insurance Corporation (Washington, D.C., 15 April 1983).

34. See, for example, Edward J. Kane, "A Six-Point Program for Deposit-Insurance Reform," *Housing Finance Review* 2 (July 1983): 269-78; Bert Ely, "Private Sector Deposit Guarantees: An Alternative to Federal Deposit Insurance," unpublished paper, 4 May 1984; Catherine England and John Palffy, "Replacing the FDIC: Private Insurance for Bank Deposits," *Backgrounder*, Heritage Foundation, no. 229 (2 December 1982); and Eugenie D. Short and Gerald P. O'Driscoll, Jr., "Deregulation and Deposit Insurance," *Economic Review*, Federal Reserve Bank of Dallas, September 1983, 11-22.