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The Japan – U.S. Bilateral Trade

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The bilateral trade imbalance between the United States and Japan has already improved in real terms since the exchange rate changes. However, the degree of improvement has been moderate to date. This paper examines factors influencing the adjustment process of the trade imbalance, focusing on relative price changes and structural factors.

Since the meeting of the G-5 nations (France, Japan, United Kingdom, United States, and West Germany) in September 1985, a significant realignment of exchange rates has taken place. Between September 1985 and November 1987, the dollar fell against the Japanese yen from 236.63 yen/dollar to 135.37 yen/dollar — a depreciation of 42.8 percent. Against a basket of major currencies, the dollar depreciated over this period an average of 34.3 percent.[1] In response, policymakers shifted their primary concern from encouraging further depreciation of the dollar to stabilizing its value near current levels.

Such a drastic change in exchange values was expected to help correct international trade imbalances. In general, a currency realignment influences real trade flows by changing relative prices between domestic and foreign tradables, thereby altering the quantities of domestic and foreign goods demanded. If the adjustment in exchange rates were sizable and sustained long enough to convince people that the trend would not be reversed in the foreseeable future, it might also provoke supply responses.

Japan's trade surplus in *real* terms, in fact, has contracted markedly since the beginning of 1986, as import quantities have risen and export quantities fallen (Table 1). In addition, Japan's *nominal* trade surplus has started to decline as well. With such changes in external trade performance, the growth pattern of the Japanese economy has experienced a rapid transformation from growth led by external demand to growth led by domestic demand.

Since trade between Japan and the United States forms the largest part of the two countries' respective external imbalances, Japanese policymakers and their U.S. counterparts have paid keen attention to developments in Japan's bilateral surplus with the U.S. A better understanding of the recent evolution of that trade therefore is important. This paper seeks to contribute to that understanding by: 1) analyzing what actually has occurred to the real bilateral merchandise trade since the currency realignment, and 2) examining the factors affecting the adjustment process of the bilateral trade imbalance.

With these two themes in mind, the remainder of this paper is organized in the following manner. The first section reviews the recent evolution of trade between Japan and the United States. Sections II and III discuss several influences on the adjustment process in the bilateral trade imbalance, focusing on the role of relative price changes and structural factors. The last section offers a summary and conclusions, as well as policy implications.

I. Exchange Rate Realignment and the Japan-U.S. Trade

In fiscal 1986 (from April 1986 to March 1987), Japan's *nominal* trade surplus with the U.S. swelled by $8.7 billion and recorded an all-time high of $52.0 billion. This enormous bilateral trade surplus now accounts for more than half (57.9 percent in fiscal 1986) of Japan's total trade surplus. Viewed from the U.S. perspective, this surplus is a trade deficit amounting to 34.5 percent of its total trade deficit, and one that is far larger than its trade deficit with any other single trading partner. Although Japan's *nominal* surplus with the U.S. shows signs of flattening out or even declining modestly in recent quarters (from $4.6 billion in the fourth quarter of 1986 to $4.3 billion in the third quarter of 1987, based on seasonally adjusted monthly averages), the extent of improvement has remained moderate due to the so-called J-curve effect. The J-curve describes the typical pattern of adjustment to changes in the relative value of a currency. Specifically, as a currency appreciates, export prices rise and lead at first to an *increase* in the nominal value of exports even though the real value (that is, the quantity) falls as higher prices lead to reduced demand. With time, even the nominal value of exports falls as demand fully adjusts to the higher prices.

To measure accurately the effectiveness of the currency realignment in correcting trade imbalances, it is necessary to examine the *real* bilateral trade balance.

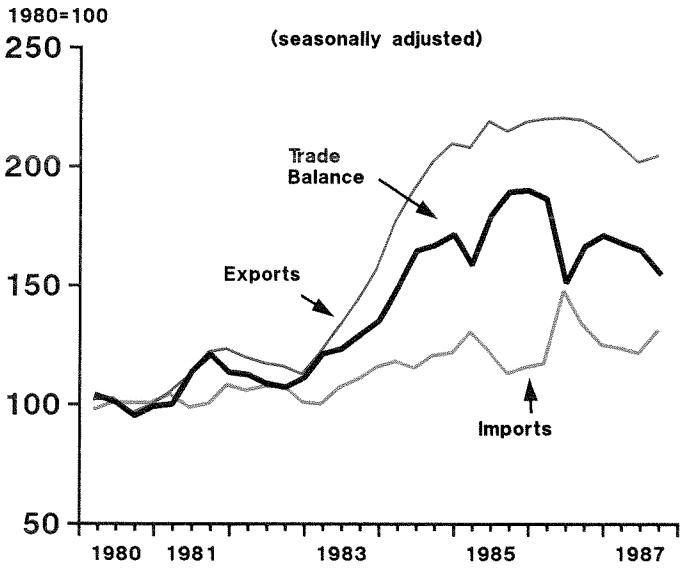
An examination of Japan's real trade balance with respect to the U.S., presented in Chart 1,[2] shows that Japan's real exports to the U.S. began to fall around mid-1986, while its real imports from the U.S. took an upward turn with large fluctuations arising from imports of nonmonetary gold.[3] Correspondingly, its real trade balance with respect to the U.S.[4] has declined.

Two observations are in order, however. First, despite the sharp appreciation of the yen against the dollar, Japan's real exports to the U.S. have not diminished significantly. In fact, Japan's real exports to the U.S. dropped only by 2.7 percent between the third quarter of 1985 and the first quarter of 1987. Second, Japan's real imports from the U.S. have not grown as quickly as those from other regions. Japan's real imports from the U.S. recorded growth of 9.7 percent during the period, compared to growth rates of 48.9 percent and 22.3 percent, respectively, from the European Community and Asian countries.[5] These qualifications require further analysis.

Chart 2 shows that Japan's real exports to the U.S. have been depressed by the rise in relative prices since 1986, and that part of this effect has been offset by slow but continued growth in the U.S. economy and the high income elasticity of Japan's exports. These results come from a regression equation including relative price and U.S. income variables.

Since a variety of Japan's export items have been under administrative or voluntary export/import restraints,[6] any

Chart 1
Japan's Real Trade with the U.S.



Source: Ministry of Finance

Table 1

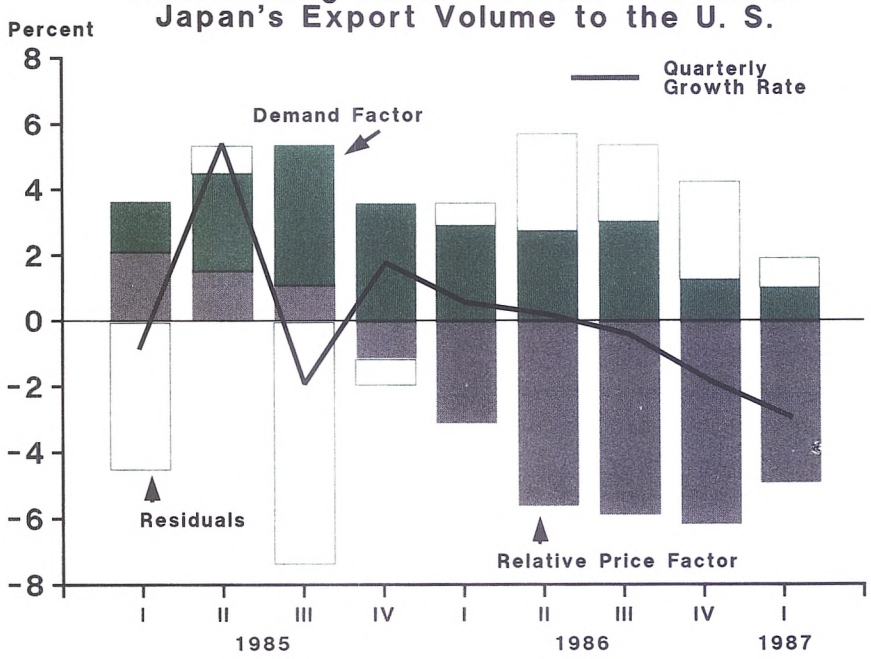
Japan's Nominal and Real Trade Balance

(Billions of dollars; customs clearance basis)

Fiscal Year	Nominal Balance	Real Balance (1980 dollars)
1980	− 5.9	− 6.9
1981	9.2	5.3
1982	9.3	6.8
1983	23.3	14.3
1984	35.1	24.9
1985	52.6	28.8
1986	89.8	5.0
1987/1st half (annual rate)	74.6	−13.3

Source: Ministry of Finance (Japan)

Chart 2
Contributing Factors to the Growth of Japan's Export Volume to the U. S.



1. Contributing factors were estimated from the following real export equation:

   In (real exports to the U.S.) = 3.46 * In (U.S. real domestic demand*)
   (17.5)
   + 1.13 * In (relative price**)
   (8.4)
   − 12.38
   (− 13.8)

   sample period: 1976/2Q − 1987/1Q
   R2 = 0.9229

2. Serial correlation corrected by a Cochrane-Orcutt adjustment (RHO = 0.74).
3. Independent variables are two-quarter moving averages of U.S. real domestic demand and four-quarter moving averages of relative price.

* real GNP - real net exports

**weighted average of U.S. PPI and Japan's competitors' export prices / Japan's export prices

analysis based on this traditional specification of an export equation may not capture price and income effects perfectly. Nevertheless, the reasonably good fit of the real export equation estimated indicates that the yen's steep climb has been a dominant factor in limiting the growth of Japan's exports during the period under study.[7] The positive residuals, however, suggest that other factors must be examined to help explain why Japan's exports have not responded even more. Likewise, it is important to analyze the factors that have contributed to somewhat weak growth in Japan's imports of U.S. goods.

In the following two sections, we will look at some of the factors that have been affecting the current adjustment of the Japan-U.S. bilateral trade imbalance in more detail. The analysis will focus on 1) whether the deterioration in Japan's relative export prices has, in fact, been restrained relative to the depreciation of the dollar; 2) why and how Japan's exports to the U.S. have been so responsive to the growth in U.S. demand; 3) whether the composition of U.S. trade with Japan has influenced U.S. exports to Japan; and 4) whether the improvement in U.S. relative export prices fully reflects the dollar's depreciation.

II. Factors Affecting Japan's Real Exports

Pricing Behavior Under the Strong Yen

Although Japan's real exports to the U.S. have been substantially depressed by a rise in relative export prices, many analysts contend that Japanese exporters have limited increases in their export prices and, instead, have squeezed their profits in yen terms to prevent a marked decline in their market shares. In other words, adjustment in the bilateral trade imbalance has been delayed by the practice of restraining export price hikes.

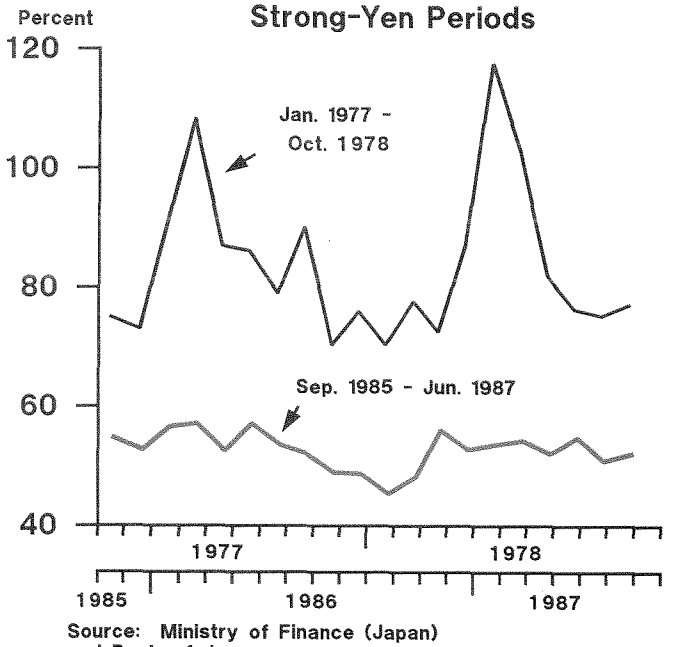
To analyze this argument, it is useful to introduce the concept of "cumulative pass-through." The cumulative pass-through is defined as the ratio of the cumulative percent change in export prices to the cumulative percent change in exchange rates during a given period. The pass-through in the current "yen-daka" (strong yen) phase is much lower, hovering within a range of 50-55 percent,[8] compared to a ratio of 70-80 percent during the last strong yen period in 1977-1978 (Chart 3). This lower pass-through indicates that Japan's export prices have been less responsive to exchange rate movements in the more recent period.

Since Japanese exporters' pricing strategies cannot be independent of their competitors' prices in world markets, it is useful to examine how Japan's export prices responded to changes in competitors' prices. To do so, we decomposed Japan's cumulative pass-through ratio into two factors — "the world price inflation factor" and "the Japanese exporters' adjustment factor" (Table 2). The first factor measures the pass-through implicitly assuming that Japan is a price-taker in the world export market.[9] The second factor takes account of the extent to which Japanese exporters may have been able to adjust their export prices in response to various elements such as foreign competition, foreign demand growth, and differences in quality of products.

When we compare the value of each of these two components in the period 1985Q3-1987Q1 with their values in the period 1977Q1-1978Q4, it is clear that both lower world-wide inflation and increased foreign competition at a time of slower foreign demand growth contributed to the lower pass-through in the more recent period.

The more modest increases in foreign export prices in the later period reflect the greater price stability worldwide since the early 1980s. Many have argued that such price stability has limited the opportunities to pass currency appreciation through to export prices. At the same time, price stability, especially of raw materials, lowered the domestic output costs of Japanese exporters and enabled them to restrain the pass-through.

Chart 3
A Lower Export Pass-Through Rate in the More Recent Strong-Yen Periods



Source: Ministry of Finance (Japan) and Bank of Japan

The reduced adjustment of Japan's export prices to foreign export prices can be attributed mainly to stiff competition from newly industrializing countries (NICs), especially those in southeast Asia. For instance, Korea, Hong Kong, and Singapore's combined share of U.S. imports rose from only 3.7 percent in 1975 to 4.5 percent in 1980; their share rose another 2.7 percentage points in the following six years. Some of this increase in market share may be ascribed to the fact that since 1985 the exchange rates of their currencies have not appreciated against the U.S. dollar as much as they have against the yen.

In short, confronted with greater competition within a stable price environment worldwide, Japanese firms were unable to raise their export prices fully in response to the rise in value of the yen. As a result, they accepted lower unit sales (in terms of yen) from exports to avoid drastic cutbacks in their production.[10] Thus, it is clear that reduced pass-through has dampened the effect of the currency appreciation on adjustments in export quantities.

Commodity Composition of Japan's Exports

In addition to the restrained adjustment in export prices, another factor that has played a role in the moderate trade adjustment to date is the commodity composition of

Table 2

Breakdown of Pass-Through

Period	Pass-Through	World Price Inflation Factor	Japanese Exporters' Adjustment Factor
1977Q1-1978Q4	75	41	33
1985Q3-1987Q1	54	26	28

Notes:

$$\text{Pass-through ratio} = \frac{\text{cumulative \% change in export price (B)}}{\text{cumulative \% change in exchange rate (A)}}$$

$$= \text{(cumulative \% change in export price of industrial countries)/(A)}$$

$$+ \text{(B - cumulative \% change in export price of industrial countries)/(A)}$$

The "world price inflation factor" is defined as the first term of the right-hand side above, and the "Japanese exporters' adjustment factor" as the second term.

Source: OECD, Ministry of Finance (Japan), Bank of Japan

Japan's exports to the U.S. This section examines the role of structural factors in Japan's exports.

The analysis presented here divides Japan's real exports to the U.S. into several major commodity categories[11] — consumer goods, production goods, capital goods *including* office machinery, and capital goods *excluding* office machinery. Chart 4 shows that real exports of consumer goods to the U.S. have been falling since the beginning of 1986. This decline is primarily the result of the rise of Japan's relative consumer goods export prices rather than an overall decline in U.S. demand for consumer goods. In fact, private consumption remained strong in the U.S. while Japan's real exports of consumer goods dropped 20.2 percent between the first quarter of 1986 and the first quarter of 1987.

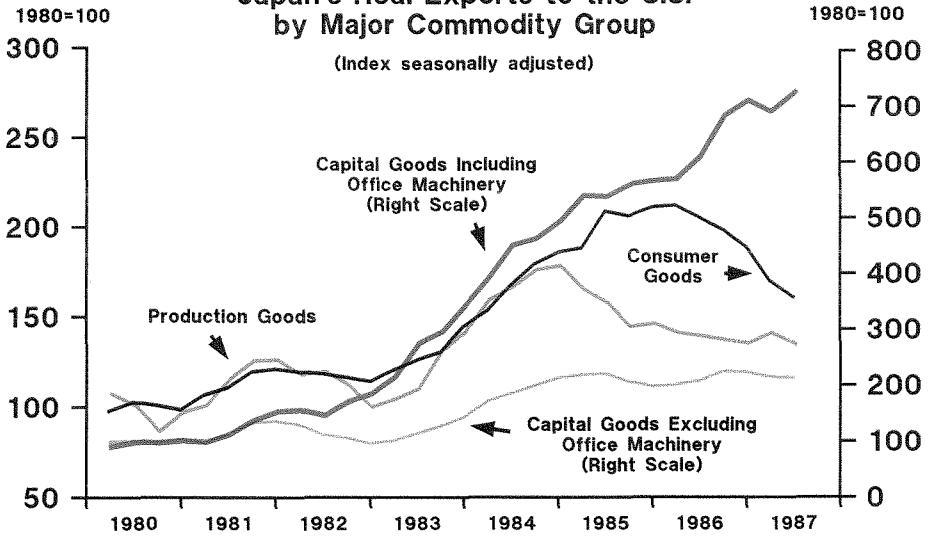
Real exports of production goods, which ballooned in 1983 and 1984 in response to the pick-up in U.S. industrial output, began to decline in the first half of 1985 and have continued to decline through the first part of 1987. The decline was, to a certain extent, due to the stagnant business climate surrounding the worldwide electronics industry. It also may have been due to the voluntary export restraint on steel and iron introduced in October 1984, since the export quantity of production goods exclusive of these commodities has followed a slightly upward trend.

Finally, real exports of capital goods *including* office machinery have increased quite rapidly in spite of the yen's steep rise (the current level is about seven times higher than in 1980), while the export volume of capital goods *excluding* office machinery has remained virtually unchanged since 1985 (the present level is about twice as high as in 1980). These observations suggest that exports of office machinery have played a major role in sustaining Japan's overall exports despite the yen's rapid appreciation.[12]

The strong growth of office machinery exports is related to changes in the structure of U.S. import demand. U.S. private nonresidential fixed investment recovered quite vigorously after 1983, fueled by tax reduction measures. In the process, U.S. investment demand shifted toward information processing machinery and related peripheral equipment, partly because advances in electronic technology made such equipment considerably less expensive. Office machinery and related equipment doubled its share in total nonresidential equipment investment from 16.1 percent in the 1970s to 35.4 percent in 1985. The higher relative price of U.S.-produced office equipment[13] allowed imports of these items to flood in (more than a 30 percent increase at an annual rate). Its share in U.S. total imports more than tripled in the last six years from 1.2 percent in 1980 to 3.9 percent in 1986.

A rapid response by Japan's exporters to changes in foreign demand, supported by technological advances and competitive prices, and Japan's subsequent penetration of the U.S. market[14] have kept the income elasticity of Japan's exports at a fairly high level. This high income elasticity, together with sustained U.S. growth, have partially offset the export quantity adjustment effect of the yen's appreciation.

Chart 4
Japan's Real Exports to the U.S. by Major Commodity Group
(Index seasonally adjusted)



Source: Ministry of Finance (Japan), Department of Commerce

III. Factors Affecting Japan's Real Imports

The Commodity Composition of Japan's Imports

As mentioned earlier, the growth in Japan's imports of U.S. goods has been relatively moderate to date compared with its imports from other trading partners. As a result, the U.S. share of Japan's total imports, excluding those from the Middle East, has fallen from 38.4 percent in 1960 to 26.9 percent in 1986, in sharp contrast to the sizable gains by Asian NICs (+7.6 percent points in the 26 years) and the European Community (+7.1 percent).

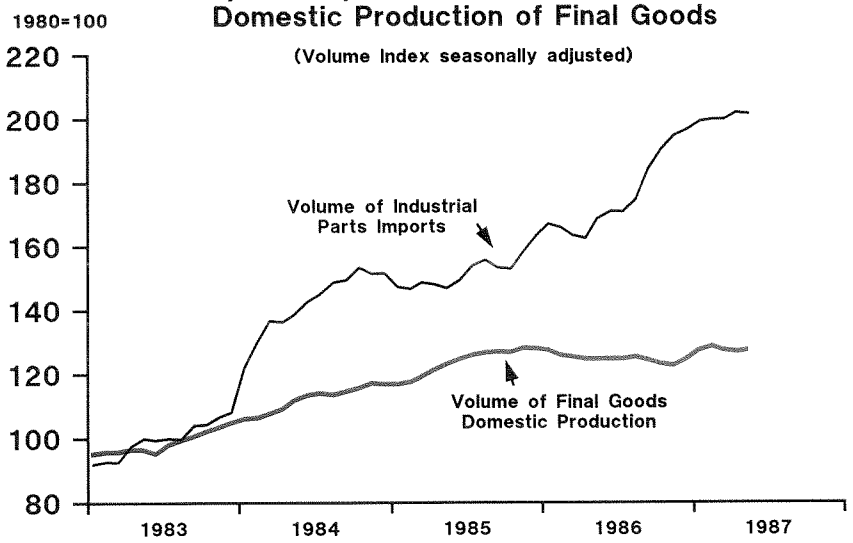
Japan's aggregate real imports recorded seasonally adjusted growth of 12.8 percent between the third quarter of 1985 and the first quarter of 1987. This increase was dominated by accelerated imports of manufactured goods (an increase of 23.0 percent). During the same period, Japan's real imports of raw materials showed practically no gain (a meager increase of 1.8 percent) and imports of foodstuffs did not increase as fast as those of manufactured goods (an increase of 14.0 percent).

These developments reflect structural changes that have been occurring in the Japanese economy. As illustrated in Chart 5, imports of various kinds of industrial parts and equipment (including those for general machinery, telecommunication equipment, electric household appliances, automobiles, and computers) have been increasing steadily, while the growth of domestic production of these final goods has been lackluster. Between September 1985 and February 1987, the aggregate import volume of these items increased by more than 20 percent annually, while domestic industries' output increased only slightly (+0.9 percent at an annual rate). Concurrently, in materials-processing industries such as metals, petroleum, chemicals, and textiles, a similar shift from domestic production using imports of raw materials to imports of semi-finished products is evident as a long-run trend. Imports of semi-finished products increased by about 50 percent between the end of 1979 and March 1987, while domestic production of those semi-finished goods remained virtually unchanged, and imports of raw materials gradually declined.

Thus, a steady increase in imports of intermediate products generally has been evident in Japanese manufacturing industries. Moreover, imports of final products, especially of consumer goods, also have grown rapidly as a result of an increase in overseas production by Japanese firms.[15] In this regard, it is significant to note that such changes can be interpreted as a substitution of imports for domestic production. This shift was encouraged not only by changes in relative prices but also by technological advances and increased supply capacity abroad.

With this structural shift in mind, a comparison of the commodity composition of U.S. exports to Japan with that of the European Community is useful. The combined

Chart 5
Japan's Imports of Industrial Parts and Domestic Production of Final Goods



Source: Ministry of Finance and Ministry of International Trade and Industry (Japan)

1. Japan's import volume of industrial parts is a weighted sum of import quantities of 76 commodities (such as, parts of electric machinery and transportation machinery).

2. Domestic production of final goods is a weighted sum of production indices of electric machinery, transportation machinery, and general machinery.

share of foodstuffs and raw materials in U.S. exports to Japan (39.2 percent) is more than twice as large as that in EC exports (14.8 percent), whereas the share of manufactured goods in U.S. exports (60.7 percent) is much smaller than that in EC exports (85.5 percent). Thus, EC exports have more of what Japan wants. This partly accounts for the much faster growth in imports from the EC than from the U.S. In sum, given the structural changes in the Japanese economy, the countries whose exports comprise more manufactured products have obvious advantages.

The structural composition of U.S. exports helps to explain why *overall* U.S. exports to Japan have grown more slowly. However, this alone cannot explain why the growth in U.S. exports of *individual* commodity categories also has lagged behind the same commodities exported by other nations. The data on commodity imports in Table 3 implies that the primary cause of the slower growth in U.S. exports does not lie in import barriers since the barriers apply to all exporting countries in the same way. In the next section, we examine another factor that may account for the divergent behavior — the adjustment of U.S. relative export prices.

Adjustment of U.S. Relative Export Prices

An historical comparison of United States producers' pass-through ratios during the past three periods of dollar depreciation (Table 4) shows that the ratio of exchange rate depreciation to a fall in foreign currency export prices (106 percent) in the present weak dollar phase is far higher than those in previous periods. In other words, the prices of U.S. exports in foreign currency terms have dropped by more than the depreciation in the exchange value of the dollar.

As a result of this change in U.S. exporters' pricing behavior, U.S. export unit value *in dollar terms* in 1986 remained practically unchanged from the previous year (+0.3 percent), and its unit value *expressed in yen terms* declined by 29.2 percent. Although this improvement was partially offset by more stable prices in Japan, U.S. relative export prices declined by 25.6 percent against Japan's domestic prices and returned to the pre-1980 level (Table 5).

However, this improvement in the price competitiveness of U.S. exports to Japan must be weighed against other competing countries' export price behavior as well, since U.S. exporters compete with other countries in the Japanese import market. An examination of major competitors' export prices relative to Japan's domestic prices reveals that the improvement in U.S. relative export prices is not all that dramatic. In fact, according to Table 5, U.S. export prices relative to those of its major competitors still are relatively unfavorable. Thus, the degree of the overall

Table 3

Japan's Imports by Commodity and by Region

(in 1986; percent changes over the previous year; in U.S. dollar terms)

Commodity	Total	United States	European Community	Asian NICs
Grand total	− 2.4	+12.6	+ 57.3	+27.2
Foodstuffs	+23.4	+ 4.8	+ 43.4	+51.6
Textile materials	−13.5	−42.9	− 0.1	+ 5.7
Metal ores and scrap	− 7.5	− 2.9	− 1.2	−13.1
Other raw materials	+ 2.6	+ 5.4	+ 40.3	+19.5
Mineral fuels	−33.9	−18.2	+140.0	−31.9
Chemicals	+20.6	+ 5.0	+ 36.9	+52.2
Machinery and equipment	+18.8	+ 3.8	+ 57.2	+32.7
Other	+43.8	+89.3	+ 77.9	+36.7

Source: Ministry of Finance (Japan)

Table 4

Historical Comparison of Pass-Through in Three Phases of Dollar Depreciation

Phase	Pass-Through*	Percent Change in Foreign Currency Export Price***	Percent Change in Exchange Rate**
1970Q4-1973Q3	45.9	−10.0	−21.8
1977Q1-1978Q4	32.5	− 5.4	−16.6
1985Q1-1987Q2	106.3	−40.4	−38.0

* *Pass-through defined as percent change in foreign currency export price divided by the percent change in exchange rate*

** *Percent change in multilateral trade-weighted value of dollar*

*** *The dollar export price is translated into foreign currency terms by the multilateral trade-weighted value of dollar.*

Source: Federal Reserve Board, Department of Commerce

Table 5

Improvement of U.S. Relative Export Price

Export unit value of country/Domestic WPI of Japan (1980 = 100)

Year	United States	West Germany	United Kingdom	Italy	Korea
1980	100.0	100.0	100.0	100.0	100.0
1985	117.4	78.1	82.9	84.3	100.0
1986	87.4	76.0	72.0	76.4	75.2
Percent change 1986-1985	− 25.6	− 2.7	− 13.1	− 9.4	− 24.8

Export unit value of the U.S./Export unit value of country (1980 = 100)

Year	West Germany	United Kingdom	Italy	Korea
1980	100.0	100.0	100.0	100.0
1985	150.4	141.2	139.4	117.5
1986	115.0	121.4	114.4	116.1
Percent change 1986-1985	− 23.5	− 14.0	− 17.9	− 1.2

Source: International Monetary Fund and Bank of Japan

improvement has been much smaller than the change in the nominal dollar/yen exchange rate (29.4 percent in 1986 over the previous year) or the change in the dollar's real bilateral exchange rate against the yen (25.6 percent).

In this connection, it is worth noting that U.S. export prices relative to those of its competitors still are about 15 to 20 percentage points higher than they were in 1980 when the U.S. trade account was roughly in balance. In other words, U.S. exporters have not yet restored their lost price competitiveness following the dollar's appreciation through 1985. It is also significant that the cumulative change in relative export prices against Japan's domestic prices since 1980 still is far more advantageous to other countries.

These facts are important because the differences in the *levels* of relative export prices may influence the growth in each countries' exports to Japan, given the structural changes in the Japanese economy. The growth of new Japanese import demands likely alters the historical relationship between imports and other variables, such as export prices and income growth.

As we have seen in Sections II and III, various factors have influenced the adjustment of the bilateral trade imbalance between Japan and the U.S. The change in the commodity composition of Japan's exports in response to changes in U.S. demand and the structural features of U.S. exports have played important roles in trade flows between the two nations. In addition, the delayed adjustment of Japan's export prices due to the restrained pass-through and the inadequate improvement of U.S. export prices relative to competing exporters' prices have weakened adjustment to the currency realignment. However, these factors cannot fully account for the relatively moderate correction of the trade imbalance. For instance, controversial microeconomic factors such as the effect of export restraints on Japan's exports and the nonprice competitiveness of U.S. exports are not studied in this paper. These points will have to be addressed in future studies.

IV. Summary and Conclusions

The currency realignment in foreign exchange markets since the meeting of G-5 nations in September 1985 has contributed appreciably to the adjustment of international trade imbalances. The improvement of the bilateral imbalance between Japan and the U.S., however, has been somewhat limited by structural factors and other elements that have diminished the impact of the adjustment of relative prices. Exchange rate changes alone are not sufficient to eliminate the bilateral trade imbalance. In addition, restructuring the Japanese economy for less dependence on external demand as well as restoring U.S. competitiveness through heightened productivity growth and restrained unit labor costs are both indispensable for redressing the bilateral trade imbalance in the long run.

Japanese manufacturing industries are already moving their production abroad through foreign direct investment and by expanding imports of manufactured commodities to substitute for domestic production. Moreover, many Japanese industries such as iron and steel, chemicals, and construction machinery are now placing more emphasis on domestic business since domestic demand is robust and domestic sales have become more profitable. Such developments should make Japan's imports more responsive to growth in domestic demand and its exports less elastic with respect to growth in foreign demand.[17] In the meantime, improvement in such fundamental determinants of U.S. competitiveness as productivity growth and reduced unit labor costs has been observed along with advantageous shifts in U.S. exporters' pricing behavior.

These trends suggest that the structural changes required for further reductions in the bilateral trade imbalance are emerging on both sides of the Pacific. Structural changes will redress the imbalance in the long run, not measures that focus on curbing Japan's exports since these exports still have high income elasticities and U.S. income still is growing. Even if it were possible to reduce Japan's exports to the U.S. so steeply as to restore balance, foreign economies would suffer from the impact of this policy because of the resultant contraction in Japan's import demand.

Accordingly, the best solution to the bilateral trade imbalance should focus on durable growth in Japan's imports from the U.S. In this regard, the most important issue is whether the current strong growth in Japan's manufactured imports can be sustained or not. The issue of Japan's barriers to agricultural imports is secondary in the sense that the effect of removing these barriers on bilateral trade is fairly small in comparison to the effect of growth in Japan's manufactured imports.[18]

With a view to supporting the economic restructuring process indirectly, Japanese policymakers have been implementing measures to stimulate domestic demand and stabilize exchange rates in cooperation with other major developed countries. Correcting the current external

imbalance requires sustained growth in Japan's domestic demand, not only because it induces more imports, but also because it is conducive to minimizing the frictional costs that accompany economic restructuring. Yet, it is hardly possible to eliminate Japan's huge nominal trade surplus in a year or two, because of the still-high income elasticity of Japan's exports and the existing wide gap between exports and imports. The conclusion that most clearly emerges from this analysis is that Japanese policy authorities have to achieve sustained growth in domestic demand and maintain price stability over a fairly prolonged period.

The United States can contribute to reducing its trade deficit by improving U.S. relative prices. As shown in the text, this has been achieved so far by the dollar's decline against major currencies. However, since the exchange value of the dollar has already declined sharply, further improvement of U.S. relative prices must be achieved through productivity growth and reduced production costs. At the same time, since inflationary pressure has been mounting from the import side as a result of the dollar's depreciation and there are some signs of tightening supply/demand conditions in the U.S. economy, fiscal and monetary policies aimed at future noninflationary economic growth also are needed.

FOOTNOTES

1. Weighted-average exchange value of the U.S. dollar against the currencies of other G-10 countries plus Switzerland, published by the Federal Reserve Board. Weights come from the 1972-1976 global trade of each country.

2. Japan's real exports and imports with the U.S. can be obtained by deflating dollar values of exports to, and imports from, the U.S. by export and import price indices. In this paper, the export and import price indices with respect to the U.S. have been calculated as follows:

a) Calculate the commodity composition of exports to, and imports from, the U.S., using the "*Summary of Report, Trade of Japan*," Japan Tariff Association.
b) Find the export (or import) price index in yen terms of each goods category in the same data source.
c) Obtain the price index of total exports (or imports) with respect to the U.S. by making a weighted average of the price indices of goods, the weight being the share of each goods category in total exports (or imports) with respect to the U.S.
d) Translate the yen-denominated price indices thus calculated into those in dollar terms by the prevailing dollar/yen exchange rate.

3. In fiscal 1986, Japan imported gold from the U.S. on several occasions for the purpose of coining gold coins in commemoration of the 60th anniversary of the current emperor's reign.

4. Japan's real trade balance with its major trading partners, including the U.S., is measured by a ratio of Japan's real exports to its real imports.

5. In 1986, U.S. exports of industrial supplies and materials to the European Community (EC) and Asian countries increased substantially (+9.5 percent and +11.9 percent over the previous year, respectively). Accordingly, there is the possibility that some of these exports ultimately went to Japan in the form of final products exported from the EC and Asian countries to Japan.

6. Japanese exports currently subject to U.S. trade restraints (in fiscal 1986) and their shares in Japan's total exports to the U.S. are as follows:

Shares in Japan's Total Exports to the U.S.

(Percent)

Export Quantity Restraints		
Passenger cars	25.6	
Steel and iron	2.5	
Textiles	1.4	
Metalworking machinery	0.9	
Subtotal		30.4
Export Price Restraints		
Metalworking machinery	0.9	
Integrated circuits	1.2	
Cameras	0.8	
Subtotal		2.9
Import Restraints		
Cellular telephones	0.1	
Pagers	0.03	
Light trucks	4.7	
Motor cycles	0.6	
Subtotal		5.4
Grand total		37.8

7. It should be noted that the regression analysis employed here implicitly assumes that income and price elasticities have not changed over time.

8. Although the aggregated cumulative pass-through ratio for Japan's exports between September 1985 and April 1987 was 54.9 percent, there is considerable variance among individual commodities:

Foodstuffs	34.7%
Textiles and textile products	35.7
Chemicals	36.1
Non-metallic mineral products	43.9
Metals and metal products	26.1
Machinery	63.2
Miscellaneous manufactures	40.9

9. Although such an assumption was introduced in this paper for the sake of simplicity, it should be noted that in reality Japan's export prices also affect its competitors' export prices.

10. It should be borne in mind that the swollen profit margins that had been attained during the last weak yen period enabled Japanese exporters to squeeze their profits in this process and, in this sense, cushioned the impact of the yen's appreciation. The ratio of current profit to sales in principal manufacturing industries climbed to 4.65 percent in the first half of 1984 and stayed at that level through the first half of 1985. Subsequently, it declined sharply to the recent trough of 2.85 percent in the first half of 1986, reflecting profit-squeezing in exports. The relationship between U.S. import prices and profit margins from the U.S. perspective has been analyzed by Catherine L. Mann in "Prices, Profit Margins, and Exchange Rates", *Federal Reserve Bulletin*, June 1986.

11. Japan's real exports to the U.S. of individual commodities can be obtained by deflating the dollar value of exports of the commodity by its export price index. Real exports of each commodity category (for example, consumer goods) are calculated by aggregating real dollar values of individual commodities in accordance with the definitions of commodity categories given below:

a) Consumer goods
   foodstuffs, television sets, automobiles, motor cycles, cameras, watches, tape recorders, shoes, toys

b) Production goods
   chemicals, textiles, metals, tires, integrated circuits, non-metallic mineral products

c) Capital goods
   power generating machinery, office machinery, metal-working machinery, electrical machinery

12. This viewpoint was first raised by Daniel E. Nolle and Charles Pigott in the *Quarterly Review*, Federal Reserve Bank of New York, Spring 1986.

13. Actually the U.S. producer price of office machinery rose 8.2 percent between 1980 and 1986 while Japan's export price of office machinery in dollar terms fell by about 20 percent. Accordingly, U.S. relative prices deteriorated by about 35 percent during the period.

14. "Import penetration" is defined as the ratio of imports of manufactured goods to domestic absorption (namely, GDP + imports − exports). This ratio shows that Japan has rapidly penetrated the U.S. market in recent years (0.6 percent in 1970; 1.2 percent in 1980; 2.0 percent in 1986).

15. For instance, as a result of foreign direct investment, the so-called "boomerang effect" is evident in Japan's imports of household appliances from Asian NICs as depicted in the table below. This effect may be partly responsible for a rapid increase in Japan's manufactured imports from Asian countries.

Import Volume by Commodity and by Region

(Percent change in fiscal 1986 over the previous year)

Portable stereos	(Korea)	+ 230
Personal stereos	(〃)	+ 230
Electric fans	(〃)	+ 330
Refrigerators	(〃)	+ 230
Television sets	(Taiwan)	+ 650
Calculators	(〃)	+ 250
Washing machines	(〃)	+83.4
Sewing machines	(〃)	+59.9

16. In this paper, a variable weight export deflator was used to calculate the pass-through ratio.

17. Although the extent to which the structural economic changes have affected Japan's balance of payments cannot be quantified exactly, an attempt was made by the Bank of Japan to estimate changes in the income elasticities of Japan's exports and imports by means of Kalman filtering models. According to those estimates, the income elasticity of Japan's exports has declined gradually while that of its imports has risen sharply since early 1986 (see *Special Paper No. 155*, "Quarterly Economic Outlook", Autumn 1987).

18. According to a paper by Dick K. Nanto (submitted to the Subcommittee on Economic Goals and Intergovernmental Policy of the Joint Economic Committee of the U.S. Congress on December 9, 1985), Japan's liberalization of agricultural imports will increase U.S. exports to Japan by $1.7 to $5.3 billion. However, the effect is of a once-and-for-all nature and, once Japan's agricultural imports are liberalized, such an increase cannot be expected to last. In contrast, the increase in U.S. manufactured exports to Japan by $12.6 billion in 1986 does represent a trend given the structural changes in the Japanese economy. Such exports may even grow if U.S. competitiveness improves further.

U.S. Banks' Exposure to Developing Countries: An Examination of Recent Trends

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U.S. banks' total LDC loan exposure and exposure relative to assets and capital have declined since the LDC debt crisis began in 1982. The authors find, however, that exposure to troubled LDCs has not fallen as much as exposure to more creditworthy borrowers, and that exposure has become increasingly concentrated at the largest U.S. banks. They posit three possible explanations: involuntary lending, banks' relative advantages in working with troubled borrowers, and the existence of deposit insurance, which distorts lending decisions.

In February 1987, the government of Brazil announced that it was suspending interest payments on its debts to commercial banks. This debt-service moratorium came as no surprise to the international financial community since Brazil's ability to meet the regularly scheduled payments of principal and interest on its obligations had been deteriorating for some time. Nonetheless, Brazil's action underscored the lingering concerns about a number of lesser developed country (LDC) debtors following the 1982 debt crisis.

In view of renewed worries about the economic health of LDC debtors and the continued high level of exposure to those borrowers within the U.S. banking industry, a number of U.S. banks took action to increase their loan loss reserves in June 1987. All told, these additions to loan loss reserves amounted to over $15 billion. Bank stock values responded favorably, but questions remain concerning the adequacy of these actions.

Moreover, bank regulators remain concerned about U.S. banks' exposure to developing countries. For example, as part of its risk-based capital proposal announced in July 1987, the Federal Reserve Board suggested that all banks with large exposures to high-risk countries be required to maintain capital positions above the minimum ratios.

This paper examines U.S. banks' exposure to international borrowers, with a particular emphasis on the subset of troubled LDCs. It attempts to explain the pattern of exposure that apparently concentrates international lending risk in the banking system. The paper is organized in the following way. In the first and second sections, we describe the events leading up to the debt crisis that erupted in August 1982, when Mexico announced a moratorium on debt service, and how the debt crisis affected bank lending to developing countries.

Readers who are familiar with this background material may wish to turn directly to the third section where we take a closer look at U.S. banks' exposure to developing countries since the debt crisis. We find a number of surprising and possibly disturbing developments, including an increase in U.S. banks' exposure to troubled LDCs relative to their exposures to other international borrowers and an increasing concentration of that total exposure at the largest U.S. banks. In the fourth section, we attempt to explain these developments. The paper concludes with a discussion of policy implications.

I. LDC Lending in Historical Perspective

Prior to the 1970s, longer term lending to developing countries occurred primarily through official sources. The bulk of private capital flows, to the extent they occurred, took the form of foreign direct investment. Private lenders such as commercial banks tended to provide funds primarily to finance trade.

Even before the first oil crisis in 1973-74, however, the role of private lenders began to change dramatically. Some have suggested that the rapid rise in the U.S. money supply in the early 1970s and the adoption of floating exchange rates increased liquidity, particularly in the form of Eurodollars, and led to a rise in international lending by commercial banks. The first oil shock then generated current account deficits for oil-importing countries and equally large surpluses in the current accounts of the Persian Gulf countries. Private lenders, most notably commercial banks, facilitated the flow of funds between lending and borrowing countries.

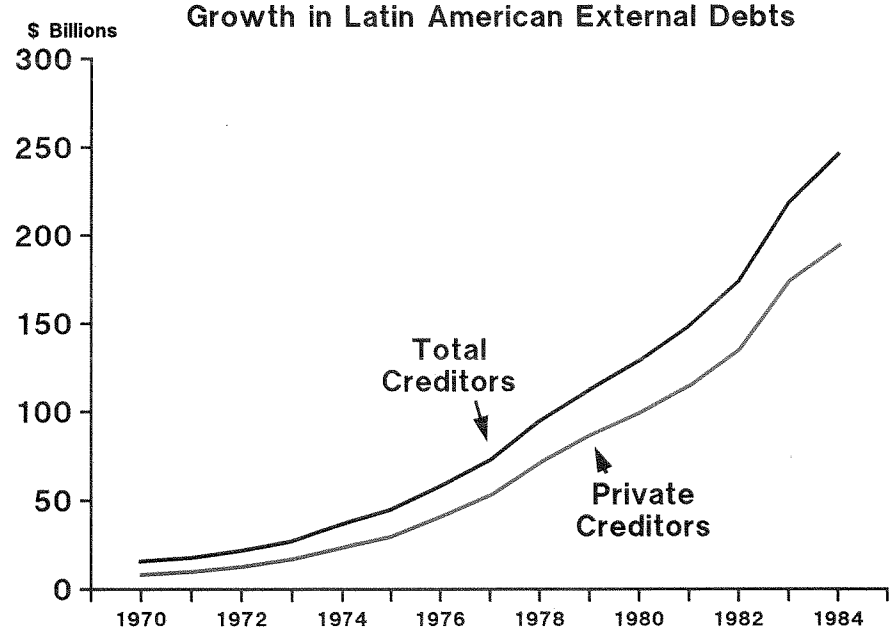
Chart 1 shows the growth in the external indebtedness of Latin American countries to all countries from 1970 through 1984. It is clear that private lenders' (primarily banks) share of the total funds advanced to those countries increased significantly. Moreover, data on bank lending suggests that U.S. banks took an active role in supplying credit to LDCs generally, with exposure reaching a peak of $166.2 billion in 1983.

Although several developing countries experienced debt service problems during this period, in general, the high inflation of the middle and late 1970s guaranteed that the real, or inflation-adjusted, debt service burden was quite low because loans were repaid in devalued dollars. Moreover, rapid growth of the economies of the industrial countries generated strong demand for the exports of developing countries. Consequently, very few LDCs experienced payment difficulties despite the rapid growth in the nominal value of their indebtedness.

Beginning in the early 1980s, a number of factors combined to increase LDC debtors' real debt burdens. First, real interest rates rose dramatically as central banks moved to reduce inflation by tightening credit. The rise in real interest rates was translated immediately to LDCs' borrowing costs since most of LDCs' debt was short- or medium-term at floating rates tied to a market rate, such as LIBOR (London Inter-Bank Offer Rate). Second, in 1982, worldwide inflation unexpectedly abated. Long-term debt obligations that were contracted on the assumption that export prices would continue rising suddenly became more costly in real terms. Worse yet, the decline in inflation was not translated into lower nominal interest rates.

Moreover, the value of the dollar, the currency in which most loans to LDCs were denominated, rose relative to

Chart 1
Growth in Latin American External Debts



Source: The World Bank, World Bank Debt Tables

LDC currencies, making it more expensive for developing countries to earn dollars with which to service their debts. Ordinarily, the rise in the value of the dollar would have stimulated demand for developing countries' exports, enabling them to generate additional foreign exchange. Instead, a worldwide recession reduced the demand for developing countries' exports and made it extraordinarily expensive for LDCs to obtain foreign exchange to service their debt obligations.

These developments culminated in Mexico's announcement in August 1982 that it was imposing a moratorium on the payment of interest on its debt obligations. A payments "crisis" ensued. Mexico's creditors were able to negotiate a "restructuring" of Mexico's debt to alleviate near-term debt service problems, but by then a number of other LDCs were experiencing similar difficulties.

At this point, default on LDC loans and the potential for collapse of the international financial system became a real concern. Official policymakers and private lenders adopted similar approaches to managing the crisis for all debtors experiencing difficulties. First, to obtain short-term financing from the IMF (International Monetary Fund), the debtor country had to reach an agreement with the IMF concerning an economic reform program designed to improve the longer term outlook for its debt service capacity. Second, once an IMF agreement was reached, banks had to reach an agreement with the debtor to reschedule their loans. Initially, these reschedulings established higher fees and spreads over the cost of funds to compensate banks for lengthening loan maturities. In subsequent reschedulings, spreads and fees were reduced even as loan maturities were extended. (Actually, funds provided by the IMF also were conditioned upon the country reaching an agreement with its bank creditors.) Finally, in a number of cases, banks also provided additional new funds at reduced interest rates primarily to enable countries to cover their contractual interest payments. Typically, banks participated in these new loans in proportion to their outstanding exposures to the borrower.[1]

II. Bank Lending and Changing Risk Perceptions

As the crisis unfolded, investors abruptly changed their assessment of the probability of default on LDC debt obligations. This sort of change in perceived default probabilities can be inferred from the sharp decrease in the value of outstanding claims on LDCs. The behavior of prices in the bond, bank loan, and, indirectly, the bank equities market is consistent with this view.

Articles by Edwards (1986), Folkerts-Landau (1985) and Dornbusch (1986) examine the international bond and bank loan markets' reactions to Mexico's announcement. These articles compare yields on international and foreign bonds issued by individual developing countries with those issued by industrial countries. They find that the yield spread increased dramatically in the third quarter of 1982, suggesting that investors required substantially higher default risk premia for LDC debt than previously. It is interesting to note, moreover, that default risk premia increased for all the major non-OPEC LDC debtors, suggesting an across-the-board reassessment of default probabilities with respect to LDC debt. Edwards also finds that the international bond market only anticipated the debt crisis by a few weeks, and then only partially.

In addition to the evidence from the international bond market, these articles find that risk premia on bank loans to LDCs rose during the early 1980s, as well. Terrell (1984), for example, notes that spreads over LIBOR for selected major LDCs increased from an average of 125 basis points through the first seven months of 1982 to 217 basis points during 1983.

Additional evidence for the change in perceived default risk is available from the secondary market for bank loans to LDCs. This market has existed for some time but became more prominent after the onset of the debt crisis. For example, the financial press noted the emergence of secondary market discounts of 10 to 25 percent relative to the face value of LDC loans in 1983.[2] (Secondary market discounts of 50 percent or more are not uncommon for loans to certain LDCs today.) Since the trading volume in this market was (and still is) quite thin, prices may not give an accurate indication of the *level* of default risk, but the *change* in those prices provides at least some indication that investors' assessment of default risk changed for the worse.[3]

Other studies have focused on the stock market's reaction to the debt crisis. In general, these studies conclude that investors tended to discount the market values of banks that had large exposures to developing country debt. Beebe (1985), for example, found that between 1982 and the end of 1984, the sharp downward valuation of the equities of the largest bank holding companies (those with assets over $10 billion) can be explained in part by their individual exposures to Latin American debtors, specifically Argentina, Brazil, Mexico, and Venezuela. Kyle and Sachs (1984) likewise find evidence that the market tended

to discount the share prices of banks with significant exposures to Argentina, Brazil, Chile, Mexico, and Venezuela between September 1982 and June 1983.[4]

Given the strong evidence for an increase in perceived default risk following Mexico's actions, one would expect to see a sharp decrease in the supply of loans to LDCs. While it may be difficult to attribute patterns in LDC lending to supply versus demand factors, the observed decline in new lending is at least consistent with the view that lenders became less willing to extend credit after the debt crisis. According to data published by the Organization for Economic Cooperation and Development (OECD), new medium- and long-term bank lending to LDCs dropped from an average of $39.2 billion a year in the period between 1978 and 1982 to $24.1 billion after 1982.[5]

Moreover, only a relatively small proportion of the "new" lending to LDCs after the crisis actually represents a net increase in the amount of borrowed funds available to those countries. Instead, most of the new lending reported by the OECD involves rollovers of maturing obligations and/or reschedulings. Net new funds typically have been provided only to enable the borrower to meet interest payments coming due on outstanding obligations. In addition, most of the lending (whether on a net or a gross basis) has been considered "involuntary" in the sense that it takes place at below-market clearing rates and commercial bank lending syndicates have had to invoke "fair-share" rules with varying degrees of success as a means of inducing members to continue to provide funds.

In fact, because commercial bank lending to LDCs dropped off so dramatically, in October 1985, Treasury Secretary Baker announced the so-called Baker Plan. The Plan established modest goals for concerted net new lending by commercial banks in conjunction with increased official lending to the fifteen principal LDC debtors. (For a list of the "Baker Fifteen," see Appendix A.) Nonetheless, net new lending to these countries has been meager at best. In 1986, loans outstanding actually declined by nearly $3 billion.[6]

III. Effect on U.S. Bank Portfolios

The increase in the perceived probability of default on LDC loans lowered the value of the loans outstanding to LDCs. As a result, U.S. banks suffered market value capital losses even though they generally did not re-value LDC loans on their books, or increase their loan loss reserves significantly until the spring of 1987. Based on data compiled from a variety of sources, U.S. banks apparently wrote down only $2.2 billion, or approximately 1.7 percent, of their loans to non-OPEC LDCs between 1982 and 1985.[7] Moreover, total provisions to increase loan loss reserves likewise were modest, averaging approximately 0.51 percent of assets per year during this period.[8]

However, U.S. banks did take other steps to counter the effects of the decline in the market values of their portfolios. For example, banks raised additional capital through increased retained earnings, asset sales, and sales of new equity and subordinated debt. They also curtailed asset growth overall, and LDC loan growth particularly. Terrell (1984) notes, for example, that banks raised front-end fees on LDC loans as a means of curtailing lending. Outstanding loans to LDCs fell from a total of $152.6 billion in 1981 to $133.6 billion at the end of 1986. As a result of these actions, exposure to LDC debtors steadily fell between 1982 and 1986.

Charts 2 and 3 show the marked change in U.S. banks' LDC debt exposure, in relation both to total assets and book value capital for those banks with significant international lending exposure.[9] In the years preceding the debt crisis, both total assets and book capital grew at roughly the same annual rate (11.9 and 11.6 percent, respectively), while loans to LDCs grew at a faster rate (14.9 percent, on an annual basis). As a result, both measures of LDC loan exposure rose between 1977 and 1982, the former reaching more than 13 percent of assets and the latter more than 243 percent of capital. Then, beginning in 1982, exposure relative to capital, in particular, declined. By 1986, it was about half the level of 1981.

Most of this decline is the result of banks' efforts to raise book capital. Between 1982 and 1986, banks increased capital at a 13.2 percent annual rate, while LDC loans outstanding declined at only a 5.0 percent annual rate. Most of these loans originally were short-term, and banks, in theory, could have chosen not to refinance them upon maturity. In practice, once the credit had been extended, banks apparently were unable to force repayment of principal.

Moreover, closer examination of the patterns of exposure — among LDCs and other international borrowers, as well as exposure by size of bank — yields some interesting and possibly disturbing observations. First, exposure to all nations excluding LDCs, declined more rapidly than total LDC exposure. For example, U.S. banks' exposure to the major industrial nations, that is, the

G-10 countries plus Switzerland, declined 57.3 percent from 210 percent of capital in 1981 to 90 percent in 1986. Total international loan exposure relative to capital declined by 55.2 percent. In contrast, LDC loan exposure declined by 52.7 percent. Thus, the decline in LDC loan exposure is not nearly as dramatic when one considers the decline in lending to other, more creditworthy international borrowers.

Second, within the category of LDC borrowers, the decline in U.S. bank exposure has varied, with more dramatic declines reported for the LDCs that are not experiencing debt problems. To analyze this development, we grouped LDCs into two categories — "troubled" and "not troubled". The troubled borrowers were selected according to the following criteria: they received a rating of worse than average by *Institutional Investor*, and/or their outstanding bank loans were trading at a discount of more than ten percent of face value in the secondary market. Furthermore, in most cases, troubled countries have a recent history of balance of payments difficulties, economic instability, and actual defaults on their obligations. (Appendix A contains a list of the countries that fall into the troubled category, as well as a list of the "Baker Fifteen" countries.)

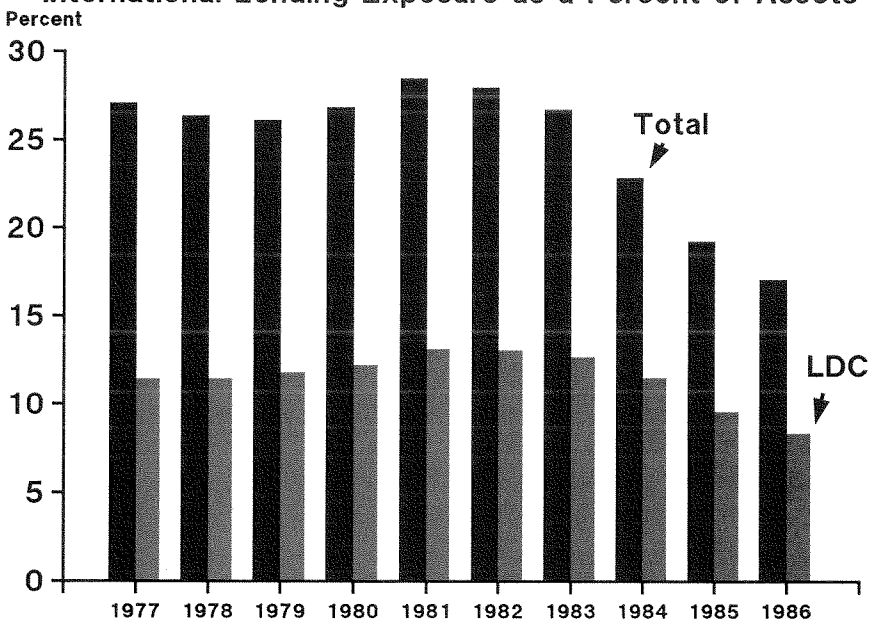
One way of measuring the change in banks' exposure to these two groups that attempts to control for the common factors that may have caused a general decline in international lending is to examine the change in these borrowers' shares of U.S. banks' international loan portfolios. Thus, Table 1 shows that exposure to what we have termed troubled LDCs has risen from 26.1 percent of banks' international loan portfolios in 1982 to 29.4 percent in 1986. Moreover, exposure to the Baker Fifteen has risen from 25.9 to 31.3 percent of banks' international loan portfolios. At the same time, loans to industrialized countries have fallen from 39.7 percent to 37.7 percent, and loans to nontroubled LDCs have fallen from 12.0 percent to 11.5 percent.

Thus, although borrowing by troubled LDCs has declined in absolute terms, borrowing by more creditworthy borrowers has declined by more. As a result, banks' relative exposure to troubled LDCs has risen. By implication, banks have tended to keep the worst risks in their portfolios. Consequently, the decline in total LDC exposure observed in Charts 2 and 3 overstates the decline in U.S. banks' exposure to default risk associated with lending to LDCs.

A third observation is that exposure by size of bank also has varied, with the nine largest banks holding a larger percentage of troubled LDC loans now than in 1981. As a percentage of total loans outstanding to troubled borrowers, the nine money center banks reporting on the

Chart 2

International Lending Exposure as a Percent of Assets



Source: Country Exposure Lending Survey

Table 1
Shares of U.S. Banks' International Loans Outstanding by Country Group
(Millions of Dollars; Percent of Total)

Year	Total		G-10 and Switzerland		Non G-10 Developed		OPEC LDCs		Non-OPEC LDCs Non-Troubled		Non-OPEC LDCs Troubled		Baker 15		Other	
1977	$194571	100%	$83610	43.0%	$16114	8.3%	$15945	8.2%	$14479	7.4%	$50699	26.1%	$40992	21.1%	$13723	7.1%
1978	217337	100	92044	42.4	17172	7.9	21342	9.8	17337	8.0	54117	24.9	47485	21.8	15324	7.1
1979	246161	100	99065	40.2	18330	7.4	22347	9.1	22958	9.3	63716	25.9	54826	22.3	19745	8.0
1980	286527	100	118503	41.4	20997	7.3	23319	8.1	29935	10.4	74739	26.1	66846	23.3	19034	6.6
1981	332057	100	131422	39.6	26084	7.9	25441	7.7	37626	11.3	87708	26.4	81520	24.6	23776	7.2
1982	352293	100	139824	39.7	29742	8.4	27760	7.9	42424	12.0	92033	26.1	91084	25.9	21509	6.1
1983	357343	100	136766	38.3	32417	9.1	28613	8.0	43717	12.2	93897	26.3	94229	26.4	21933	6.1
1984	323324	100	113400	35.1	30529	9.4	26164	8.1	39019	12.1	93819	29.0	95375	29.5	20393	6.3
1985	294542	100	105528	35.8	26986	9.2	22242	7.6	33761	11.5	87257	29.6	90525	30.7	18769	6.4
1986	275639	100	104017	37.7	22728	8.2	19550	7.1	31676	11.5	81112	29.4	86172	31.3	16556	6.0
Mean				39.3		8.3		8.2		10.6		27.0		25.7		6.7
Standard deviation				2.5		0.7		0.7		1.7		1.6		3.6		0.6

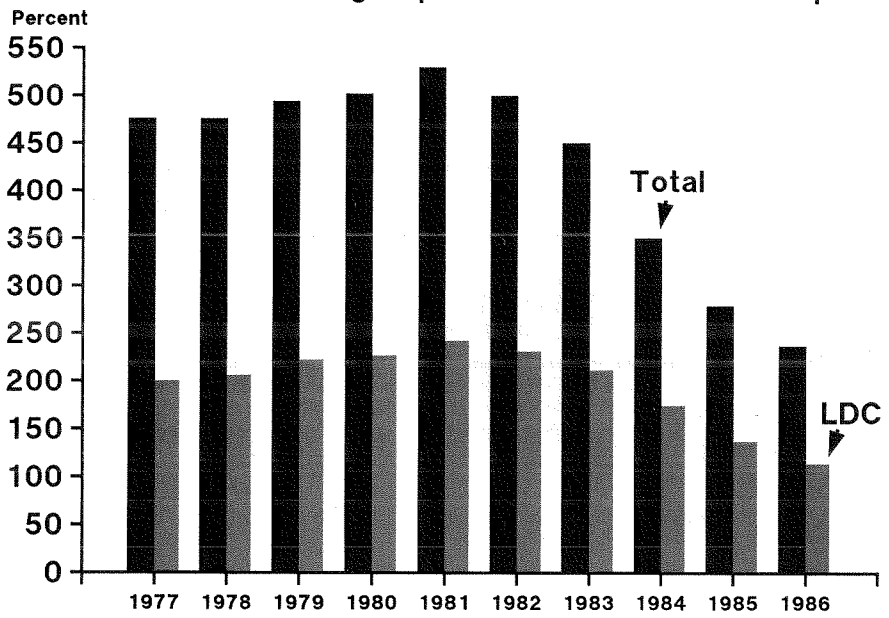
Figures may not add due to rounding
Source: Country Exposure Lending Survey, Federal Reserve Board

Table 2
Shares of U.S. Banks' Exposure to Troubled LDCs by Size of Bank
(Millions of Dollars; Percent of Total)

Year	Total		Nine Money Center Banks		Next 14 Largest Banks		All Other Banks	
1977	$50699.4	100	$30757.0	60.7	$ 9389.5	18.5	$10552.9	20.8
1978	54116.7	100	32585.3	60.2	10155.8	18.8	11375.6	21.0
1979	63715.7	100	39482.7	62.0	11320.3	17.8	12912.7	20.3
1980	74738.8	100	44388.0	59.4	13273.2	17.8	17077.6	22.8
1981	87707.8	100	50099.5	57.1	16565.1	18.9	21043.2	24.0
1982	92033.3	100	51925.2	56.4	18249.9	19.8	21858.2	23.8
1983	93896.8	100	53571.3	57.1	18594.1	19.8	21731.4	23.1
1984	93819.2	100	56004.5	59.7	18492.3	19.7	19322.4	20.6
1985	87257.0	100	54084.3	62.0	15496.7	17.8	17676.0	20.3
1986	81112.0	100	50884.0	62.7	14521.0	17.9	15707.0	19.4
Mean				59.7		18.7		21.6
Standard deviation				2.1		0.8		1.6

Figures may not add due to rounding
Source: Country Exposure Lending Survey, Federal Reserve Board

Chart 3
International Lending Exposure as a Percent of Capital



Source: Country Exposure Lending Survey

CELS now hold 63 percent compared to a low of 56 percent in 1982. Table 2 shows that, in contrast, the other two groups of banks — the next 14 largest and all other international lenders — systematically reduced their proportional shares of the total U.S. bank exposure to troubled LDCs. To a certain extent, this reduction represented a shift toward more creditworthy borrowers and a general tendency to reduce international lending altogether.

In terms of absolute changes in exposure, the nine money center banks reduced their troubled LDC loans outstanding by only $1 billion, while the next 14 largest banks and all other banks reduced theirs by $4 billion and $6 billion, respectively, from 1982-1986. The latter two groups tended to be more active sellers of loans in the secondary markets. Also, the non-money center banks' participation in involuntary new lending arrangements associated with debt reschedulings has been relatively limited. For example, *Fortune Magazine* reported in July 1983 that many of the nine largest banks provided more than their proportional shares of the rescheduled loans to Brazil because the other lenders, including many in the next-largest category, provided substantially less than their original shares.[10]

IV. Explanations

Many observers now suggest that involuntary lending provides an explanation for these patterns in U.S. banks' exposure to LDCs. As noted earlier, LDC borrowers were able to meet debt service obligations through additional borrowing prior to the crisis. However, with the decline in the market's perception of these borrowers' creditworthiness, new funds became scarce.

To induce existing lenders to provide some relief, a number of debtors threatened to default. Lenders with outstanding claims against these borrowers, then, were faced with the choice of forbearing and/or rescheduling those claims, selling the claims at a discount to other creditors, or declaring the borrowers in default and attempting to recover value through whatever remedies might be available. The sale of such claims at a discount would have involved the recognition of accounting losses, and declaration of default probably would have entailed even greater losses since the value of collateral generally was less than the discounted value of the claim. Lenders therefore may have been reluctant to pursue either of these two options, particularly when the exposure to a given borrower was large relative to the lender's capital. Consequently, lenders — particularly the largest ones with the largest exposures and thus the most to lose in the event of

default — may have "chosen" to reschedule existing loans and even to extend new loans to cover interest payments on existing obligations to avoid losses associated with default.

However, because *all* existing lenders, whether they participated or not, would have benefitted from the extension of new credit, LDC lending syndicates had to invoke fair-share rules to ensure that adequate additional funds were provided to prevent default. Nonetheless, lenders with relatively small outstanding exposures had little incentive to participate in such lending. This may explain the difference in the patterns of exposure among the three size categories of U.S. banks.[11]

While the involuntary lending explanation is consistent with the patterns we have observed for banks, it is not entirely satisfactory. A number of troubled LDCs also had bonds outstanding prior to the crisis. In the absence of distortions, one would expect, on the basis of the involuntary lending explanation, the two groups of lenders — the bondholders and the banks — to respond similarly to the debt crisis. Yet the two appear to have responded quite differently.

Nearly all accounts of the management of the debt crisis suggest that it was the bank lenders and *not* the bondholders that were involved in debt reschedulings and extensions of new credit. Moreover, data on funds raised in international capital markets also suggest that unlike bank loans, bond financing, at least for certain countries, became nonexistent after the crisis.

This implies, in other words, that reliance on bank loans increased relative to bonds as the credit rating of the borrower declined. Moreover, nonbank creditors apparently became even more reluctant to supply funds to a borrower with a given low credit rating after the crisis than before.

To show the difference in the way bank lenders and bondholders behaved, we regressed the ratio of bank loans to total external funds raised (including bonded debt) in international capital markets by a given country in a given year on the credit rating of that country for that year. Clearly, because of the way this ratio is defined, an increase implies that reliance on bonded debt has decreased. Bank loans were defined as the sum of international bank loans and foreign bank loans, but not floating

Table 3

Percent of Bank Loans to Total Funds Raised (OECD)

Year	G-10	Non-LDC	LDC	Non-Troubled	Troubled	Baker 15
1977	34.2	37.1	80.9	74.5	78.1	78.3
1978	65.1	61.4	86.6	86.5	88.0	87.5
1979	42.7	51.1	93.9	95.2	92.9	93.7
1980	55.6	59.3	95.4	97.0	93.9	95.1
1981	27.1	34.3	79.1	89.5	72.8	73.8
1982	38.5	43.3	82.1	75.7	84.6	86.1
1983	20.4	26.2	85.7	72.3	98.0	98.2
1984	44.1	46.2	89.4	75.6	100.0	100.0
1985	35.7	38.0	74.7	61.8	98.8	99.3
1986	20.5	25.7	76.0	73.9	38.0*	42.3*

** The relatively low ratio of bank loans to total funds raised by these countries reflects the problems Mexico and Brazil encountered in rescheduling their bank loans in 1986. If Mexico's rescheduled debt, which appears in the second quarter of 1987 figures were included in the 1986 total, these ratios would be close to 100 percent.*

rate notes held by banks. For the credit rating, we used the country ratings published annually by *Institutional Investor* as a proxy for creditworthiness. Ideally, some sort of market measure like the actual market prices of loans would be appropriate. However, the secondary market for bank loans is thin and quotes prices for only a handful of countries. A test of the extent to which the *Institutional Investor* ratings are a good instrument for the secondary market discounts revealed that at least for the few countries for which discounts are quoted, the ratings are indeed a good proxy.[12]

To test for a change in LDCs' access to nonbank sources of funds after the crisis (and controlling for changes in creditworthiness), we included a dummy variable that takes the value of zero prior to 1982 and the value of each country's credit rating afterwards.

We used data compiled by the OECD for a sample of approximately 62 countries between 1980 and 1986.[13] These countries represent the major international borrowers during this period and include 23 industrial countries, as well as 10 OPEC, 24 non-OPEC LDCs, and 5 Eastern Bloc countries. Table 3 presents the OECD data grouped by type of borrower.

The results of our pooled cross-section time-series regression are summarized in Table 4. The negative and statistically significant coefficient on the credit rating suggests that as LDCs' creditworthiness deteriorated, bond financing "dried up" and they were forced to rely increasingly on bank loans as a source of funds. Moreover, the negative and significant coefficient on the credit rating dummy variable suggests that for a given level of creditworthiness, access to alternative sources of funds diminished after the crisis.

Table 4

Reliance on Bank Lending vs. Bond Financing

Dependent Variable: Ratio of International and Foreign Bank Loans to Total External Funds raised on International Markets by Country.

Independent Variable	Parameter Estimate
Intercept	1.185** (36.99)
Rating	−0.007** (−11.12)
Rating Dummy*	−0.003** (−6.10)
Number of Observations	492
Adjusted R-squared	.36
t-statistics are in parentheses	

* *Rating Dummy: Rating * Dummy post-1982 (= 1 after 1982).*
** *Significant at the 1 percent level.*

These findings are consistent with the view that after the debt crisis, a number of LDC borrowers were unable to obtain funds from other sources and that it was the *banks* that were "forced" to renew and reschedule existing loans to avoid defaults and to protect their investments. This would explain the small decline in banks' exposure to troubled borrowers relative to the decline in exposure to more creditworthy borrowers.

Given that the banks appear to have responded differently to the debt crisis than did the bondholders, the question remains as to why. The involuntary lending explanation does not adequately address this issue. Assuming that neither the bankers nor the bondholders were willing to "throw good money after bad," bankers must have had some inducements to continue lending that bondholders did not have. Two explanations come to mind. First, bankers may have had superior information on the ability of LDC debtors to repay, and/or superior ability to obtain repayment. Second, bank lenders may have had regulatory incentives to lend that were not available to bondholders.

In the analysis that follows, these two alternatives are examined as two different (but not necessarily mutually exclusive) factors that may have played a significant role in determining banks' willingness to lend to LDCs both before and after the crisis.[14] The first one, the "efficiency factor," has to do with advantages banks may have relative to bondholders in assessing and monitoring riskier credits and in handling problem loan workout situations. The second factor, the "subsidy factor," relates to the effects government subsidies (implicit or explicit) may have had on banks' and investors' portfolio decisions.

Efficiency Factor

One factor that may account for the increase in banks' exposure to LDCs throughout the 1970s, and, therefore, may have had a bearing on banks' response to the debt crisis is what we have termed the efficiency factor. This explanation focuses on banks' relative advantages as agents for investors in assessing the creditworthiness of borrowers, monitoring borrowers, and working through repayment problems. It draws on insights from models of principal/agent problems in lending.[15]

Broadly speaking, borrowers and investors (that is, the ultimate lenders) may use two types of financial instru-

ments to transfer savings. These can be characterized as bonds (direct finance) on the one hand, and bank loans (intermediated finance) on the other. The choice between the two will depend on the one that provides borrowers with the cheapest source of funds and investors with the highest return net of the costs associated with administering their investment. Among the usual costs associated with administering an investment are the costs of collecting and maintaining records of scheduled principal and interest payments, but they also include the cost of more or less continuously monitoring the borrower's financial condition. This sort of monitoring is necessary to prevent borrowers from engaging in activities that reduce the value of the lenders' claims.

For some borrowers, the costs of such monitoring are relatively modest since publicly available information conveys an accurate picture of their true net worth and, therefore, the likelihood of default. Since investors can readily determine when action is needed to protect the value of their claims, these borrowers generally will prefer bond finance because the standard covenants contained in bond indentures will provide adequate protection for investors at the lowest cost.[16, 17]

For other borrowers, however, monitoring may be costly because their assets are not traded and are therefore difficult to evaluate. In these cases, the standard financial ratios on which bond covenants rely will not convey accurate information about the borrower's true condition. In fact, if these borrowers were to use bond finance, it is possible that they might violate standard bond covenants and therefore be forced to seek new sources of credit or even be forced into liquidation, even though better information would have indicated that such actions were unnecessary and costly to both borrower and investor.

These borrowers therefore will prefer bank loans because banks typically have access to information about their condition that is not readily available to investors directly. For example, banks may have information about a borrower's payments activity and transactions balances that investors do not. Consequently, banks will be able to monitor the condition of these borrowers more cheaply than could the individual investors, making bank loans the cheaper source of funds. In a sense, then, the obligations of these borrowers could be worth more to investors when held in bank portfolios.

This analysis is applicable to international lending, although solvency may not always be the proper measure of default risk. Instead, a more general approach would be to treat default risk as a function of the cost of default. In cases where actual insolvency is not at issue, default risk would be defined as the value of unrestricted future access to external borrowed funds plus the value of seizable assets, to the extent such assets exist.[18] Thus, a sovereign borrower will not default as long as the cost of doing so exceeds the value of its external obligations.

Assuming investors can readily determine the value of a given borrower's external obligations relative to the cost of defaulting on those obligations, bonds will be the preferred financing vehicle. Presumably, most industrial countries as well as those LDCs with relatively small amounts of debt outstanding, significant wealth, and high returns to capital investment will be the countries that can tap the bond markets.

In contrast, LDCs that have high amounts of debt outstanding relative to GNP or other measures of capacity, or have unstable political regimes such that default through repudiation is a possibility, have found their ability to raise external funds through bond finance severely limited, and thus have had to rely chiefly on bank loans. To the extent that investors are willing to hold these obligations at all, they appear to prefer to hold them indirectly because banks can monitor and work with problem borrowers more cheaply, and because banks have better access to assets that may be seized than do individual investors.

Banks' apparent advantage in providing credit to higher risk borrowers suggests that, given the increase in demand for external funds on the part of LDCs in the 1970s, banks would have been the logical ones to supply most of the needed funds. Moreover, this analysis suggests that once the debt crisis erupted and investors became less certain of the chances of being repaid, the value of banks' ability to gauge solvency risk and to handle workout situations would have increased. Therefore, one would expect to see banks holding proportionately more of troubled LDCs' debt than before the crisis. One might also expect the banks' share of the outstanding obligations of nontroubled borrowers to fall as the debt crisis changed the relative values of these obligations as well.

This theory is consistent with the results of our regression findings that banks and *not* bondholders were involved in continued lending to troubled LDCs. Moreover, it helps to explain why banks continued to lend to the smaller borrowers even though, according to the involuntary lending explanation, there may have been less incentive to do so because exposure to these borrowers was small. A recent study by Gluck (1987) supports this view. He found that as the creditworthiness of selected LDCs improved in the years after the debt crisis, they were able to obtain bond financing and forego bank loans as a source of funds.

Folkerts-Landau (1985) and Edwards (1986) also provide some interesting evidence that is consistent with the relative advantage argument. They suggest that because banks are in a better position to reschedule and

renegotiate a borrower's obligations than are bondholders, whose primary recourse is declaring default on the obligation, risk premia on the two types of instruments should reflect these differences. Consistent with this hypothesis, they observe that default risk premia rose by substantially more on bonds than on bank loans after the onset of the debt crisis.

The relative advantage argument, then, suggests that once the debt crisis erupted and investors became more concerned about the probability of default on the part of at least some of the LDC debtors, one would expect to see an even greater preference for bank loans as opposed to bonds in those countries. As default risk increased, banks' superior ability to work with troubled debtors and ultimately, to seize assets, would have become more valuable to investors. This would explain why U.S. banks' exposure to troubled LDCs rose relative to their exposure to more creditworthy international borrowers. It also would explain why exposure became more concentrated at the nine largest banks. Since those banks are the ones most actively involved in the international payments network and in trade finance, they are also the banks best able to monitor and seize assets if necessary.

Moreover, in workout situations, lenders need to act cohesively and the fewer lenders there are, the easier it would be to achieve consensus. This view suggests first that bond finance is particularly unsuited to workout situations since it is unlikely that the myriad bondholders could be forced to work cohesively. It also suggests that the banks with the largest exposures to begin with (that is, the nine money center banks) would have had the greatest incentive to work cohesively and to continue lending to the troubled debtors.

Subsidy Factor

A second and possibly more important factor that may have induced banks to continue lending to troubled LDCs is the existence of regulatory incentives or subsidies. In general, government subsidies, either of the lender's assets or its liabilities, will distort decisions regarding risk. If the government were to underwrite at least a portion of the increased risk, lenders would have an incentive to make and hold riskier loans than they otherwise would.

These subsidies can arise in two ways. First, the government (or a multilateral official institution such as the IMF) may subsidize exposure to LDCs *directly* by providing a guarantee of the loans to LDCs. With a guarantee of this sort, the guarantor would repay the lender up to the face value of the guarantee in the event of default by the LDC debtor. Clearly, such guarantees will encourage banks to make and hold LDC debt because some or all of the increased risk is borne by the guarantor (that is, the government) and not the lender.

Of course, there have been no public pronouncements that provide unequivocal evidence of the existence of such guarantees. Sachs (1987), however, maintains that loan guarantees were an explicit part of the negotiations involving rescheduled debt.[19] Moreover, a number of other studies have argued that bank managers and investors behaved as if *implicit* guarantees existed, in part because there are clear public policy goals served by lending to LDCs. For example, Folkerts-Landau (1985) argues that the governments of the major industrial countries informally encouraged banks to lend to developing countries on the implicit understanding that the central banks would fulfill a lender-of-last-resort function if necessary.[20] Likewise, Guttentag and Herring (1985) suggest that one reason that banks allowed exposure to LDCs to become so high may be the existence of official international support for developing countries through such programs as the IMF's adjustment assistance programs.[21]

In contrast, there is little evidence that direct guarantees, whether explicit or implicit, were available for bonded debt. If guarantees were to apply only to bank loans, this would explain the willingness of bank lenders to continue lending while bondholders became more reluctant after the crisis.

A second way that the government could have subsidized lending to LDCs is indirectly — through (underpriced) guarantees of banks' liabilities. Of course, such subsidies are not available to bondholders. This sort of deposit insurance subsidy increases banks' willingness to hold risky assets generally. Since lending to LDCs was considered riskier than lending to industrial countries even prior to the debt crisis, banks would have had incentives to increase their exposure to LDC borrowers, particularly as the demand for external funds apparently increased throughout the 1970s. This could explain why a very large share of the private lending to LDCs even prior to the crisis took the form of bank loans as opposed to bonds.

Once the debt crisis erupted, the response of bank share prices and of new bank lending to troubled LDCs would have depended on the nature of the subsidy. Direct subsidies in the form of loan guarantees likely would have had less impact on stock prices and lending behavior than indirect subsidies. Specifically, with direct subsidies, one would not expect bank share values nor secondary market values of outstanding LDC loans to decline since the guarantor would have been the one to bear the losses.

The actual decline in share values and secondary market prices after the crisis suggests either that direct subsidies were not a significant factor in banks' international lending decisions, or that investors and bank managers were

unsure of the strength of such implicit subsidies. The fact that banks tended to view IMF assistance and involvement in the rescheduling of a troubled country's debt as a prerequisite for providing new funds to that country may be a reflection of this uncertainty. Alternatively, Sachs has argued that banks have been willing to continue lending as a *quid pro quo* for IMF protection with respect to outstanding obligations.[22]

Regardless of the significance of direct subsidies in banks' lending decisions, indirect subsidies (that is, subsidies associated with deposit insurance protection) almost certainly played an important role. There is a large and growing body of evidence on the so-called deposit insurance problem which suggests that indirect subsidies exert a strong influence on banks' domestic lending. Foreign lending should be no different in this regard. Moreover, the declines in bank share prices and secondary market prices for LDC loans are both consistent with this type of subsidy. Unlike direct subsidies, in the event of default, bank shareholders do bear the risk of loss with indirect subsidies even though insured depositors do not.

Also, banks' willingness to continue lending to troubled LDCs after the crisis is consistent with the view that indirect subsidies were a significant factor in lending decisions. For example, one could argue, as Furlong and Keeley (1987) have, that a lender's incentive to hold risky assets increases the closer the lender is to insolvency. Thus, the decline in the market value of banks' net worth following the debt crisis probably provided banks with an *additional* incentive to maintain their exposure to the riskier LDCs.

Finally, the regulatory accounting treatment of rescheduled and nonaccruing LDC debt also is consistent with the existence of indirect subsidies. Regulators have allowed banks to record most LDC loans at book value as long as there is some "reasonable" prospect that the bank will be repaid at least its principal investment. As a result, banks have not had to record capital losses for LDC loans even though the market value of LDC loans declined precipitously following the 1982 crisis. By allowing this sort of indirect subsidy through "capital forbearance," bank regulators may have provided some additional inducements to continue lending. (Of course, regulators have required banks to improve their book value capital-to-assets ratios since then, so the forbearance may not have been as great as it might have first appeared.)

In sum, subsidies of various sorts probably help to explain why U.S. banks' exposure to developing countries reached such a high level in the 1970s. Once the debt crisis erupted, uncertainty over how the regulators would respond to the increased possibility of default probably also helps to explain why bank share values subsequently declined and why banks reduced their new lending to troubled LDCs. Moreover, the apparent tendency for banks to keep the riskiest debt may be consistent with this view, particularly if the regulators' actions over time could be interpreted as providing assurances of willingness to forbear.

However, the existence of subsidies does not necessarily explain why seemingly only the nine largest banks could take advantage of them, unless the subsidies were directed at a group of banks considered, by both the regulators and the market, as too large to be allowed to fail. Otherwise, subsidies would have been perceived to extend to other large banks as well, if not also to the smaller banks.

Assessment

The available evidence on lending to LDCs cannot clearly distinguish among the three explanations: the involuntary lending argument, the efficiency factor, and the subsidy factor. More sophisticated tests might shed some light and, in fact, work in progress by James suggests that indirect deposit subsidies have had a lot to do with LDC lending.

However, it is likely that all three influences have been operating since they are not mutually exclusive and may even be complementary. For example, part of the reason that the governments of industrial countries may have chosen to provide protection for bank loans to LDCs may have been that, in the event of a crisis, bank lenders have a relative advantage in monitoring the borrower and in handling a problem loan workout. Moreover, multilateral organizations like the IMF may have encouraged continued lending and helped to enforce fair-share rules because the amount of funds provided otherwise would have been inadequate. Thus, the three influences could have been and probably were mutually reinforcing.

V. Summary and Policy Implications

Mexico's announcement in August 1982 had a profound impact on the market's assessment of the default probabilities associated with lending to developing countries. Specifically, default risk premia increased and the holders of existing debt suffered large market value capital losses. As a result, lenders have become less willing to extend new loans to the countries perceived as most risky. Moreover, the outstanding exposure of U.S. banks has declined through actual write-offs, repayments, and, primarily, through growth in capital accounts.

The decline in exposure to troubled LDCs, however, is not very dramatic when compared to the declines in exposure to more creditworthy international borrowers. Likewise, the largest U.S. banks now have a larger share of troubled LDC exposure than when the debt crisis erupted. This paper has posited a number of possible explanations, all of which imply that after 1982 investors developed a decided preference for holding the obligations of troubled LDCs in the form of bank loans as opposed to bonds.

Previously cited work by James suggests that indirect subsidies have played a significant role in keeping U.S. banks' exposure to the riskiest developing countries high. Consequently, bank regulators must continue to monitor these exposures carefully and encourage banks to continue to raise capital to prevent further distortions in international lending decisions.

At the same time, however, bank lending to troubled LDCs also may be a reflection of the superior monitoring capabilities banks have in working with problem debtors. As a result, the true value of these loans on banks' books may lie somewhere between their book values and their values to nonbank investors on the secondary market. Such considerations are important to proposals that would require banks either to mark their LDC loan portfolios to market and/or to hold substantially more book capital.

APPENDIX A

International Banking

List of Country Groups

G-10 Plus Switzerland

Switzerland	Germany	Canada	Sweden
Italy	United States	France	United Kingdom
Belgium-Luxembourg	Japan	Netherlands	

Non-G-10 Developed Countries

Australia	Ireland	New Zealand	Norway
Austria	Spain	Denmark	Portugal
Finland	Greece	Iceland	Turkey

OPEC LDCs

Bahrain	Kuwait	Brunei	Iraq
Oman	Nigeria	Trinidad & Tobago	Libya
Algeria	Saudi Arabia	Ecuador	Qatar
Gabon	Venezuela	Indonesia	United Arab Emirates
Iran			

Non-OPEC Developing Countries, Troubled Debtors

Argentina	Liberia	Bahamas	Jamaica
Barbados	Malawi	Bermuda	Madagascar
Bolivia	Morocco	Brazil	Mexico
Chile	Panama	Columbia	Nicaragua
Costa Rica	Peru	Cuba	Paraguay
Dominican Republic	Senegal	El Salvador	Philippines
Guatemala	Uruguay	Guyana	Sudan
Haiti	Zambia	Honduras	Zaire
Ivory Coast			

Non-OPEC Developing Countries, Nontroubled Debtors

Angola	Mauritius	Antigua	Mozambique
Botswana	Nauru	Burma	Nepal
Burundi	North Korea	Cameroon	Netherlands-Antilles
China PR	Pakistan	Congo	Papua New Guinea
Cyprus	Puerto Rico	Egypt	Singapore
Ethiopia	Solomon Islands	Fiji	South Korea
Ghana	Sri Lanka	Guinea	Swaziland
Hong Kong	Syria	India	Taiwan
Israel	Tanzania	Jordan	Upper Volta
Kenya	Vietnam	Lebanon	Yemen
Lesotho	Yugoslavia	Macao	Zimbabwe
Malaysia		Mauritania	

Baker's List of 15 Largest LDCs with Debt Servicing Problems

Brazil	Philippines	Morocco	Ivory Coast
Mexico	Chile	Colombia	Uruguay
Argentina	Yugoslavia	Peru	Bolivia
Venezuela	Nigeria	Ecuador	

FOOTNOTES

1. See Sachs (1987) for a more complete description of the rescheduling arrangements.

2. Cited in Kyle and Sachs (1984).

3. In addition, the average (for all rated countries) country risk rating published by *Institutional Investor* fell from 52.3 to 41.0 between 1980 and 1983.

4. There are a number of other studies on the impact of LDC exposure on bank share prices. See, for example, Smirlock and Kaufold (1987) and Cornell and Shapiro (1986).

5. The data on external funds raised in international markets come from the OECD's *Financial Statistics Monthly*. All data are reported in U.S. dollars and are converted on the basis of the average spot rate for the month the bonds or loans were reported. For this paper, we use year-end figures that reflect the sum of all new lending, including bond financing over the year. It should be noted, however, that these figures represent total funds raised, including reschedulings and refinancings, as opposed to net new funds raised.

6. Morgan Guaranty Trust Company, *World Financial Markets*, June/July 1987.

7. Rodney Mills, "Foreign Lending by Banks: A Guide to International and U.S. Statistics," *Federal Reserve Bulletin*, October 1986.

8. It should be noted, however, that this increase in loan loss reserves also is the result of anticipated loan losses arising from banks' domestic loan portfolios at this time.

9. Data on U.S. banks' international loan exposure come from the Federal Reserve Board's *Country Exposure Lending Survey* (CELS). This survey was first conducted in 1977 in response to a perceived need for better data on the cross-border claims of consolidated banking organizations domiciled in the U.S. with foreign branches and majority-owned foreign subsidiaries. The data are now collected on a quarterly basis. U.S. bank exposure to over one hundred countries and a number of international organizations are reported by type of borrower and time remaining to maturity, with adjustments for loan guarantees that shift exposure across countries.

CELS data are reported for three subsets of banks: the nine money center banks, the next 14 largest banks, and the remaining banks with at least $30 million in consolidated claims on non-U.S. residents and that have at least one foreign branch or foreign subsidiary (about 160 in number).

The major drawbacks of these data are that they do not cover the claims held by all U.S. banks and the country-by-country breakdown only covers exposures that exceed three-fourths of one percent of a reporting bank's capital. Also, CELS data do not cover local-currency-denominated claims.

10. Reported in Sachs (1987), cited above.

11. Krugman (1985) and Sachs (1984) have developed models that show once a sovereign borrower has run into debt problems, it may be in the interests of all the lenders involved to reschedule the outstanding obligation and extend additional funds to reduce the borrower's near-term debt burden and enhance long-term repayment prospects. However, because there is a public good aspect to new lending in that the value of any given lender's outstanding exposure will be enhanced whether or not that lender participates in providing new funds, the lenders with the smallest exposures will have an incentive to "free ride" on the new lending of the others.

12. The Spearman Rank Test showed that correlation between the *Institutional Investor* rating and the loan discount for a given country was 0.843, at a significance level of 0.0001.

13. OECD, *Financial Statistics Monthly*.

14. There may be other factors, as well. For example, Guttentag and Herring (1985) argue that bank lending to developing countries can be explained by a concept drawn from current research in cognitive psychology called "disaster myopia." However, because this view has not gained wide acceptance in the literature, it is not addressed in this article.

15. Berlin and Loeys (1986), James (forthcoming) and implicit in Folkerts-Landau (1985).

16. These covenants typically require the borrower to meet certain readily observed conditions which, presumably, are good indicators of the borrower's true net worth. These conditions include among other things, restrictions on the types of assets the borrower may invest in, the maintenance of certain financial ratios, and the maintenance of a minimum level of capital adequacy. Violations of these covenants imply that the borrower is close to insolvency, giving bondholders the right to accelerate the maturity of their claim even to the point of forcing liquidation of the borrower's assets in bankruptcy.

17. For example, the growth in the commercial paper market largely is due to the ability of larger, well-established borrowers to raise funds directly at a lower cost than through bank loans.

18. See Niehans (1985) and Glick (1986).

19. Sachs (1987), p. 21.

20. Folkerts-Landau (1985), p. 324.

21. Guttentag and Herring (1985), p. 136.

22. Sachs (1987), p. 21.

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The Practice of Monetary Targeting: A Case Study of the West German Experience

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Since the Bundesbank adopted monetary targeting in 1975, it has used two target variables — Central Bank Money and M3. We find both choices to have the properties required of a monetary target. However, the Bundesbank has not adhered strictly to its targets, retaining considerable discretion in its implementation of monetary targeting procedures. Changes in the dollar-deutschemark exchange rate have a significant impact on where the target variable ends up relative to the pre-announced range.

Rising inflation over the 1970s led to the adoption of monetary targets as a guide to monetary policy in a number of industrialized countries. The West German Central Bank (the Bundesbank) was the first central bank to announce a target for money growth. Since then, the rates of inflation that have prevailed in West Germany have been lower than those in most other industrialized nations. This paper examines the extent to which the Bundesbank has relied upon monetary targets to keep inflation under control as well as to achieve its other policy objectives.

Our analysis focuses upon two key questions. We ask whether the West German central bank's choice of a target variable has the properties required of such an aggregate. This question is especially interesting because from 1975 to 1987 the Bundesbank targeted a rather unusual monetary aggregate called Central Bank Money (CBM), which is a weighted average of the components of the broad monetary aggregate M3. Thus, we ask whether a stable relationship exists between CBM and key macroeconomic variables such as output, interest rates, and the price level. Our answer is yes.

We ask the same question for M3, which is the aggregate that the Bundesbank has announced it will target over 1988. Once again, the data is consistent with the existence of a stable relationship between key macroeconomic variables and this aggregate. In fact, the data suggests that CBM and M3 are rather similar.

We then look at the performance of the Bundesbank since the time that it began to target CBM. Despite the Bundesbank's success in keeping inflation low, it turns out that the Bundesbank's target variable has been outside the pre-announced range nearly as often as it has been within it. Furthermore, movements in the dollar-deutschemark exchange rate appear to be an important determinant of where the Central Bank Money Stock ends up relative to its target range. Clearly, the Bundesbank retains a considerable amount of discretion in its implementation of policy.

The rest of the paper is organized as follows. Section I presents a brief description of the institutional environment in which the Bundesbank operates. Section II describes the Bank's original target variable, CBM, as well as the factors that led to its choice. Section III continues the examination of CBM in a more formal way and also examines the properties of the more conventional monetary aggregates M1, M2, and M3.

Section IV looks at the conduct of monetary policy since the Bundesbank first announced a monetary target in 1975. It contains a brief description of the economic developments and some statistical analysis of the factors that have influenced monetary policy in the interim. A more detailed description of West German monetary policy since 1975 is presented in the Appendix. Section V presents the conclusions and discusses the implications of our analysis for the United States.

I. The Bundesbank and its Monetary Policy Objectives

The organization of the Bundesbank is similar to that of the Federal Reserve. The Central Bank Council is the policymaking body of the bank and is composed of the members of the directorate and the presidents of the eleven land central (that is, regional) banks. The directorate is the central executive organ, whose members are nominated by the federal government and appointed by the president of Germany after consultation with the Central Bank Council.[1]

The Bundesbank Act of 1957 emphasizes the Bank's role in ensuring the stability of the currency, which has been interpreted to include both a stable price level and a stable foreign exchange value for the deutschemark.

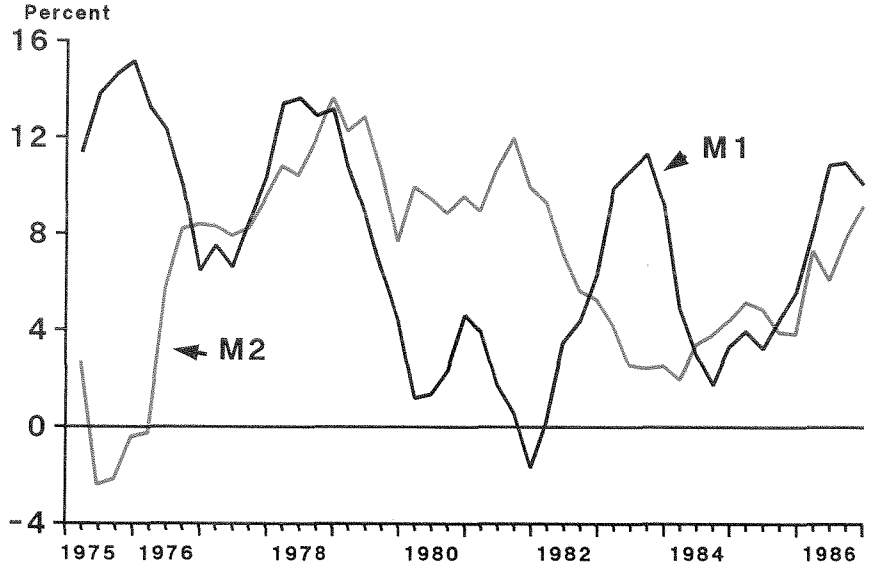
The Act allows the Central Bank a considerable degree of autonomy. While the Bundesbank is required to support the general economic policy of the government, it does not have to do so if such support were to threaten the stability of the currency. Members of the federal government are allowed to attend the policy deliberations of the Bundesbank. While they cannot vote, they can place items on the agenda and suggest that a policy decision be postponed for two weeks.

II. Choosing an Intermediate Target

Two criteria govern the choice of an intermediate target variable. The first is that the target variable be controllable by the central bank given the available instruments. The second is that its control should lead to stable and predictable effects on the economy.

The monetary aggregate called Central Bank Money (CBM) is a weighted average of the components of the broad monetary aggregate, M3. Currency is included and receives a weight of 1. The weights are .166 for demand deposits, .124 for savings deposits, and .081 for time

Chart 1
Opposite Movements in German M1 and M2*



* Growth rate is measured over the previous four quarters.

deposits. The weights on the various deposit accounts are actually the reserve requirements that were in effect in January 1974 and the weights have remained unchanged since then (although the actual reserve requirements have varied over time). CBM differs somewhat from the monetary base since it excludes excess reserves and includes only residents' holdings of deposit accounts. To understand why the Bank chose to target CBM rather than a more conventional aggregate, such as M1 or M2, it is useful to examine the circumstances leading up to its choice.

Prior to 1973, the Bundesbank paid close attention to "free liquid reserves," which consisted of excess reserves of commercial banks, short-term foreign assets, and unused rediscount quotas. However, the relationship between this aggregate and bank lending weakened in the early 1970s. In particular, bank lending continued to grow significantly even when free liquid reserves were close to zero. Faced with this shift in behavior, the Bundesbank was forced to find alternative aggregates.

M1 was not a particularly attractive candidate because experience over the 1960s had shown that changes in policy did not have predictable effects on M1. Furthermore, the decontrol of interest rates over the 1965-67 period led to an increase in the degree of substitution between demand deposits and short-term deposits. As a consequence, the Bundesbank began to look at a somewhat broader concept of the money stock consisting of M1 plus time deposits of less than six months maturity. Underlying this step was the belief that demand deposits and short-term deposits had become close substitutes due to interest rate decontrol. This aggregate was later modified by including time deposits with maturities up to 3 months only, and was called $M1_a$.

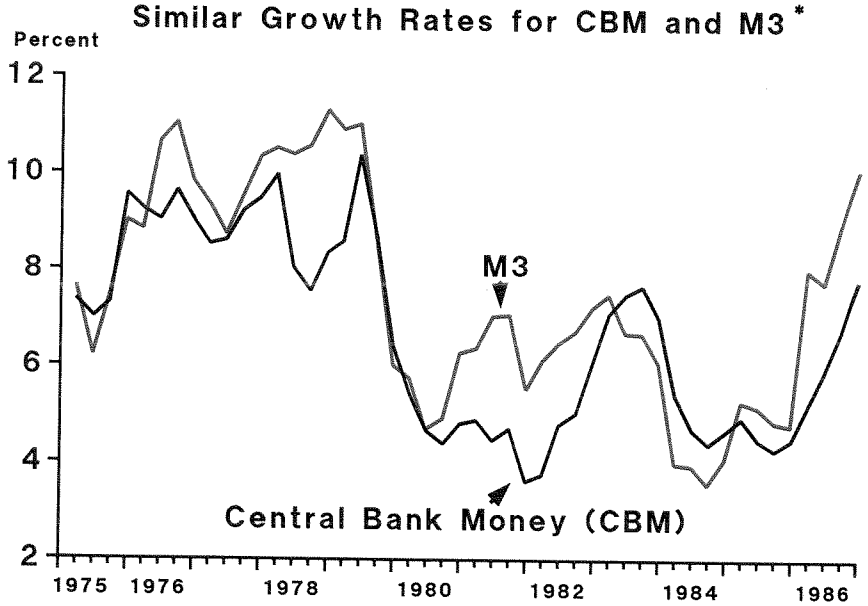
Unfortunately, sharp interest rate movements in the early 1970s demonstrated that $M1_a$ was an unstable indicator. For one thing, it turned out to have a positive interest rate elasticity. Consequently, a broader aggregate called M2 was introduced that contained M1 plus time deposits of up to 4 years maturity.[2]

However, M1 and M2 often moved in opposite directions, making it difficult to interpret what their movements really meant. Chart 1 illustrates that the high degree of substitution between M1 and M2 has continued over time. There is general agreement that these deposit swings are interest rate-induced. However, the problem for monetary policy has been the difficulty of predicting the extent of these movements.

Another margin of substitution that came to light as a result of the sharp interest rate swings of the early 1970s was that between savings and time deposits. As a consequence, the monetary authorities defined a new aggregate called M3 which consisted of M2 plus savings deposits. Although M3 was perceived to internalize the deposit shifts plaguing M1 and M2, the Bundesbank chose not to target this aggregate at that time, apparently on the

Chart 2

Similar Growth Rates for CBM and M3*



* Growth rate is measured over the previous four quarters.

grounds that assigning equal weights to demand, time, and savings deposits would exaggerate the "moneyness" of the latter two.[3]

Thus, the choice of CBM was motivated by the Bundesbank's belief that none of the existing monetary aggregates was likely to be useful as a target variable. Narrower aggregates such as M1 and M2 were likely to be afflicted by portfolio substitution, which would make it difficult to interpret movements in them, and the broad aggregate M3 was too imprecise a measure of transactions balances. A broad aggregate with more appropriate weights was, therefore, seen as the solution. This broad aggregate was expected to share some of the characteristics of M3 and, at the same time, reflect movements in transactions aggregates to a greater extent than M3.

The Bundesbank has mentioned this as the rationale for choosing CBM on several occasions:

> *The various types of deposits within the minimum reserve component of the central bank money stock (that is, savings, time and demand deposits) are consequently in a relation of roughly 4:3:2 to each other. This could approximate the varying degrees of moneyness or liquidity which the different categories of deposits are regarded as having.*[4]

Chart 2 plots the growth rates of Central Bank Money and M3 for the period 1975-1986. The growth rates of the two aggregates are close, suggesting that they do indeed have similar characteristics. We turn now to an examination of the relationship between these aggregates and various macroeconomic variables.

III. Analyzing the Monetary Aggregates

For an aggregate to be useful as a monetary target, there should exist some sort of equilibrium relationship between it and macroeconomic variables such as output, the price level, and the rate of interest. However, this requirement is more properly imposed upon the long-run behavior of the aggregate, since it would be unnecessarily stringent to require that equilibrium exist in every single period. Nevertheless the short-run behavior of the aggregate is not irrelevant. For policymakers, the usefulness of a long-run relationship between a particular monetary aggregate and key macroeconomic variables is likely to be severely impaired if short-run movements in the aggregate are largely uncorrelated with movements in those variables of policy concern.

This section presents an analysis of the properties of four alternative monetary aggregates — CBM, M1, M2 and M3. We begin by examining the nature of long-run movements in the various monetary aggregates and whether these movements are related to long-run movements in output, prices, and the interest rate. It turns out that there is no stable, long-run relationship between output, interest rates, and the real value of either M1 or M2.

We then go on to estimate money demand functions for the remaining two aggregates, CBM and M3. These demand functions allow for adjustment towards long-run equilibrium and also for the effects of short-run changes in the independent variables. The properties of the estimated demand functions provide essential information about the usefulness of these aggregates as target variables. For instance, a significant interest rate elasticity implies that the aggregate is subject to control through policy-induced interest rate movements. In addition, a stable demand function ensures that policy-induced variations in the target variable would have predictable effects on the economy.

Long-run Behavior

Recent work in econometrics has shown that it is important to determine correctly the nature of the long-term movements of a variable before attempting to carry out any estimation. Specifically, it is necessary to determine whether random disturbances have permanent effects on the level of the variable. A variable that exhibits no tendency to return to its original value following a disturbance it said to be nonstationary. Conversely, if the effects of the random disturbance were to die out over time, the variable would be said to be stationary. Of course, the variable still could be growing around a trend, in which case the series is said to be trend-stationary.[5]

The point is that conventional econometric techniques require stationarity. For example, if output, interest rates, and the monetary aggregates were stationary, then we could estimate money demand functions directly. Things are not as straightforward if some (or all) of these variables were nonstationary. We return to these issues below.

To determine whether the variables that are of interest to us are stationary (or trend-stationary, as the case may be), we use the Dickey-Fuller test for unit roots, which is described in Fuller (1976). The test consists of regressing the first difference of the variable in question on its own lagged level plus a constant, a time trend, and lagged first differences as appropriate. The null hypothesis that the

series contains a unit root (in other words, that random disturbances permanently alter the level of the series) implies that the coefficient on the lagged level should be zero. The test statistic is just the ratio of the estimated coefficient to its standard error, except that under the null hypothesis this statistic does not have the usual t-distribution. Critical values for this statistic are tabulated in Fuller.

Table 1 presents the results of this test for the levels and differences of the logs of real GNP, the real values of the four monetary aggregates,[6] and the interest rate variable (which is the rate on three-month bank loans). The sample period is 1975Q1 to 1986Q4. In each case, we have included two lags of the first difference of the dependent variable to capture the short-run dynamics. The first half of the table shows that we cannot reject the hypothesis of nonstationarity (or nontrend-stationarity, as the case may be) at even the 10 percent level for any of the series. By contrast, we can reject the hypothesis of nonstationarity at the 5 percent level for the first difference of all the series in the table.

Our findings suggest that the levels of all the variables in question contain unit roots. A variable that contains a unit root has no tendency to return to any "average" value over time (or to return to any trend value). Thus, for an equilibrium relationship to exist between a particular aggregate and variables such as output, interest rates, etc., the disturbances that cause nonstationary behavior in the monetary aggregate must also influence the latter set of variables. If the nonstationarity in the aggregate does not arise from the same sources as the nonstationarity in output, etc., the monetary aggregate will tend to drift away from the other variables.

Recent developments in econometrics provide a means of determining whether there is a long-run relationship between variables that contain unit roots. It turns out that we can test for the existence of a long-run relationship between such variables by estimating an ordinary least squares regression and examining the residuals from this regression for stationarity. A finding that the residuals are stationary means that even though the variables included

Table 1

Tests for Non-Stationarity

(1975Q1 - 1986Q4)

A. Tests for Levels of Variables*

	CBM	M1	M2	M3	Real GNP	Interest Rate
Constant	.76	.53	.18	1.0	1.52	.16
	(2.26)	(2.01)	(2.14)	(2.54)	(2.48)	(1.96)
Trend	.001	.001	–	.001	.001	–
	(1.94)	(1.88)		(2.18)	(1.95)	
Coefficient on lagged level	−.15	−.10	−.03	−.15	−.21	−.10
	(−2.23)	(−2.00)	(−2.03)	(−2.51)	(−2.46)	(−1.97)

B. Tests for Differences of Variables*

	CBM	M1	M2	M3	Real GNP	Interest Rate
Constant	.006	.003	.008	.007	.005	–
	(2.79)	(1.57)	(3.10)	(2.58)	(2.21)	
Lagged Level	−.90	−.52	−.83	−.75	−.94	−.60
	(−3.57)[2]	(−3.10)[3]	(−3.67)[1]	(−3.06)[3]	(−3.03)[3]	(−3.22)[1]

** Regressions were estimated after taking logs of all series. Each regression contains two lags of the 1st difference of the dependent variable.*

Notes: [1]Significant at 1%
[2]Significant at 2.5%
[3]Significant at 5%
[4]Significant at 10%

in the regression are nonstationary, there exists a linear combination of the variables that is stationary. Put differently, the variables will not drift away from each other. Such variables are said to be cointegrated. (See Granger and Engle, 1987.)

Table 2 presents the results of regressing the logs of the real values of each of the monetary aggregates on the logs of real GNP and the interest rate. We present two alternative test statistics. The row labelled "Dickey-Fuller Test" presents the results of the Dickey-Fuller test for stationarity of the residuals. As discussed, this test involves regressing the first difference of the residual series from the regression on its lagged level. The test statistic is the ratio of the estimated coefficient to its standard error, as before. The Durbin-Watson statistic for the original equation also can be used to test the hypothesis that the variables are cointegrated. If the variables were not cointegrated, the residuals would be nonstationary and the Durbin-Watson statistic would be close to zero. Thus, the null hypothesis of no cointegration (or alternatively, that the residuals are nonstationary) would be rejected if the Durbin-Watson statistic were large enough. Critical values for both tests are reported in Engle and Yoo (1987). Note, however, that the critical values of the Durbin-Watson statistic reported there are for cointegration in the bivariate case only.[7]

The results in Table 2 show that we can reject the hypothesis of no cointegration between CBM, real GNP, and interest rates at the 5 percent level on the basis of the Dickey-Fuller test. The Durbin-Watson statistic is also reasonably large. The Dickey-Fuller test does not allow us to reject the hypothesis of no cointegration between M3 and the other two variables at even the 10 percent level. However, the Durbin-Watson statistic for this regression is significant at the 10 percent level. For M2 and M1, we cannot reject the null of no cointegration on the basis of either test.

Although none of the more conventional monetary aggregates (M1, M2 or M3) is cointegrated with income and interest rates taken together, it is possible for them to be cointegrated with income alone. The results of the tests for cointegration between each of these aggregates and real GNP are presented in Table 3. We can reject the null hypothesis of no cointegration between M3 and real GNP at the 10 percent significance level using either the Dickey-Fuller test or the Durbin-Watson statistic. However, we cannot reject the null of no cointegration either between M1 and real GNP or between M2 and real GNP.

These results have important implications for the choice of target variable. Our evidence suggests that the real values of both M1 and M2 are subject to random disturbances that permanently alter the levels of these aggre-

Table 2

Tests for Cointegration - I

(1975Q1-1986Q4)

	CBM	M3	M2	M1
A. Estimated Equations				
Constant	−4.22	−5.02	−6.39	−3.58
	(−20.7)	(−15.1)	(−10.39)	(−9.79)
Real GNP	1.28	1.59	1.69	1.25
	(44.9)	(34.2)	(19.7)	(24.6)
Interest Rate	−0.02	−0.01	.06	−.04
	(−3.2)	(−0.96)	(3.36)	(−4.33)
B. Test Statistics				
Dickey-Fuller Test	−4.58[2]	−3.47	−2.81	−2.90
D. W. Statistic*	1.22[1]	.77[3]	.33	.58

**Critical values are only available for cases where regression contains one explanatory variable.*

Notes: [1]Significant at 1%
[2]Significant at 5%
[3]Significant at 10%

gates but that do not have similar effects on either income or interest rates. This makes it undesirable to use M1 and M2 for monetary targeting, since they exhibit no tendency toward a stable relationship with key macroeconomic variables. One implication of this finding is that if a money demand function were estimated for either of these aggregates, the absence of an equilibrium relationship likely would show up as permanent "shifts" in the estimated function.

By contrast, our results show that permanent disturbances to the real value of CBM are related to permanent disturbances to output and interest rates. The finding that CBM is cointegrated with real GNP and interest rates has an intuitive interpretation. It implies that even though these three series are subject to random disturbances that have permanent effects, these disturbances are not independent. Thus, long-run movements in the real value of CBM will tend to be closely associated with movements in output and interest rates. We also find that permanent disturbances to the real value of M3 are related to permanent disturbances to output (although the evidence here is weaker). Thus, long-run movements in M3 will mirror movements in output.

Table 3

Tests for Cointegration - II

(1975Q1 - 1986Q4)

A. Estimated Equations

	M3	M2	M1
Constant	−4.94	−6.94	−3.16
	(−15.39)	(−10.59	(−7.61)
Real GNP	1.57	1.77	1.18
	(35.70)	(19.71)	(20.75)

B. Test Statistics

Dickey-Fuller Test	−3.35*	–	−2.37
Augmented Dickey Fuller Test	–	−1.87	–
D. W. Statistic	.74*	.29	.41

**Significant at 10%*

Estimating Demand Functions

The existence of a cointegrating regression is not sufficient to ensure that either CBM or M3 will be useful as monetary aggregates since it tells us only about long-run relationships. We need to examine the behavior of these two aggregates over the short-run as well. It is tempting to do so by estimating money demand functions in the first differences of the variables, since first differencing purges the data of long-run movements. However, such a step is inappropriate when the variables are cointegrated because it means ignoring the long-run relationship that exists between them.

The appropriate way to proceed is to estimate an error correction model which forces gradual adjustment of the dependent variable toward some long-run value while explicitly allowing for short-run dynamics.[8] For example, our finding of cointegration implies that the difference between the actual value of CBM and that suggested by the cointegrating regression will tend to move back towards zero following a random disturbance. This suggests that the discrepancy between the actual and equilibrium value of CBM is likely to be one of the factors that determines the growth of CBM at any time. Of course, the growth rate of CBM also is likely to be influenced by various temporary disturbances to the other variables in the regression.

These considerations suggest that the equation to be estimated should be of the form:

$$CBM_t = a + b_i \sum_i \Delta \text{ Real GNP}_{t-i} + c_i \sum_i \Delta \text{ INT}_{t-i} + d\ EC_{t-1}$$

where Δ denotes the first difference,

INT is the interest rate, and,

$EC_t = CBM_t + 4.22 - 1.28\,RGNP_t + 0.02\,INT_t$ is the error-correction term.

The error-correction term is constructed using the coefficients from the cointegrating regression shown in Table 2. The first differenced terms capture the effects of short-run disturbances to output and interest rates while the error correction term captures the adjustment towards long-run equilibrium. A similar equation is estimated for M3, with the error-correction term obtained from the cointegrating regression shown in Table 3.

The estimated demand functions for CBM and M3 are shown in Table 4. The functions were first estimated with 8 lags of both the first difference of real GNP and the interest rate. Lags that were insignificant were then eliminated, taking care that this did not induce residual autocorrelation. The coefficient on the error-correction term in the CBM equation reveals that approximately one-fourth of

the previous quarter's discrepancy between the actual and equilibrium value of CBM is corrected each quarter. Short-run movements in real GNP and interest rates also have a significant impact on CBM growth.

The equation for M3 reveals that the previous period's discrepancy between actual and equilibrium values is a significant factor in explaining M3 growth as well. Further, while there is no long-run relationship between M3 and the rate of interest, the growth rate of M3 is temporarily affected by interest rate movements.

A Chow test was carried out to test the stability of each of the estimated demand functions. The sample was divided into two subsamples, the first extending over 1975Q1-1979Q4 and the second extending over 1980Q1-1986Q4. The breakpoint was chosen on the basis of the dollar-mark exchange rate: the dollar reached its low point against the mark in 1979Q4 and began to appreciate after that. For CBM, the computed value of the F(9,28) statistic is 1.48, which has a marginal significance level of .20. The computed value of the F(5,38) statistic for the M3 equation was 0.68, which has a marginal significance level of .64.[9] Thus, neither the demand function for M3 nor that for CBM exhibits any evidence of instability over the 1975Q1-1986Q4 period.

To summarize, the evidence presented in this section suggests that the real value of CBM has had a stable relationship with real income and interest rates over the period that the Bundesbank has been targeting CBM. Real output and the real value of M3 also appear to be similarly related. However, no stable, long-run relationship exists for either M1 or M2.

These results are consistent with the argument that the narrower aggregates are subject to random portfolio disturbances that prevent them from having a stable relationship with output. These disturbances appear to be internalized within the broader aggregate M3 to an extent that interest rate fluctuations do not appear to have any long term impact on it. The evidence also suggests that aggregate CBM has characteristics more like those of the broad monetary aggregate M3 than the relatively narrow aggregates M1 and M2. This implies that the weights attached to savings and time deposits in CBM are sufficient to offset the impact of portfolio disturbances that afflict M1 and M2 and to ensure a stable relationship between real output, the interest rate, and the real value of CBM. Thus, our analysis suggests that both CBM and M3 possess the characteristics required of a target variable.[10]

We now turn to the second issue that is of interest, namely, an examination of the actual conduct of policy since the Bundesbank began to target CBM.

Table 4

Error-Correction Specifications for Money Demand

(1975Q1 - 1986Q4)

Dependent Variable	Δ CBM_t*	Δ $M3_t$
Constant	.003	.01
	(1.94)	(7.80)
Δ Real GNP_t	.47	–
	(4.11)	
Δ Real GNP_{t-1}	−.20	−.21
	(−2.26)	(−2.05)
Δ Real GNP_{t-5}	.26	–
	(2.69)	
Δ Real GNP_{t-8}	.22	–
	(2.20)	
Δ Interest $Rate_{t-1}$	−.02	–
	(−2.16)	
Δ Interest $Rate_{t-2}$	–	−.02
		(−2.12)
Δ Interest $Rate_{t-3}$	−.03	−.03
	(−3.40)	(−3.49)
Δ Interest $Rate_{t-6}$	−.02	–
	(−2.78)	
Error Correction Term	−.24	−.20
	(−2.63)	(−3.10)
$R^2/\bar{R}^2$	.63/.53	.37/.31
Durbin-Watson Statistic	2.02	1.79
Q Statistic (Marginal Significance Level of Statistic)	23.7(.16)	17.1(.51)

**Equation contains constant dummies for 1978Q2 and 1978Q3*

Δ denotes first difference
t− statistics are shown in parenthesis

IV. West German Monetary Policy since the mid-1970s

In this section, we examine West German monetary policy since the Bundesbank began to target CBM in 1975. We begin by describing the factors that the Bundesbank takes into account in setting the target range each year, and then look at how the CBM target has varied over the years. Finally, we look at how successful the Bundesbank has been at achieving these ranges and the factors that have played a role in determining where CBM ended up relative to its target range.

By announcing a CBM target for 1975, the Bundesbank became the first central bank to announce a money growth target. In the beginning, the Bundesbank's discussion of a desirable rate of CBM growth was couched in terms of the expected growth of capacity, the desired change in capacity utilization, and the expected development of the "velocity of circulation."[11] The Bundesbank also made an allowance for the "unavoidable" rate of inflation, which was defined as "price rises which have already entered into decisions and arrangements in the economy." However, the Bundesbank stopped using the term unavoidable in 1985, explaining that "Given the large measure of price stability achieved, it would have been difficult to explain credibly why this concept should be retained."[12]

Recent discussions of the target range for CBM have been cast in terms of the growth rate of the nominal "production potential", which is further broken down into the growth rate of real production potential and a "tolerated" rate of inflation. The rate of inflation that the Bank allows for has been declining over time. For example, it was between 4 to 5 percent in 1976, between 3.5 to 4 percent in 1981, and 2 percent in 1986. The Bundesbank also retains the option of revising targets at mid-year, but has not done so until now.

Table 5 presents the target ranges as well as actual growth of CBM since 1975. The Bank announced single-valued targets for the first four years, but (convinced perhaps by the size of the errors) has been expressing its targets as ranges since 1979. It is notable that the upper bound of the target range decreased steadily from a high of 9 percent in 1979 to 5 percent in 1985. However, it went up by a half-percentage point in both 1986 and 1987. The width of the range also was narrowed to 2 percentage points beginning in the target year 1984, but was widened back to 3 percentage points for 1987. We discuss the significance of these changes below.

The Bundesbank's record in achieving its target ranges has been mixed. CBM growth was above target from 1975 to 1978 — the four years for which the target consisted of a single number. However, for two of those years the discrepancy was only around one percentage point. CBM growth did not exceed the upper bound of its target range for the next six years, actually ending up below the lower bound in 1980 and 1981. However, the target was overshot in both 1986 and 1987.

An examination of the conduct of monetary policy since 1975 provides interesting insights into how the Bundesbank reacts to different economic developments and helps explain the Bank's record of monetary targeting. (A description is contained in the Appendix.) It is quite evident that the Bundesbank attaches a great deal of importance to price level stability. But exchange rate stability — especially the stability of the mark-dollar rate — has always been an extremely important consideration. While the exchange rate is important because Germany's foreign trade comprises a significant proportion of its GNP, the focus on the dollar is probably the result of the fact that the mark is one of the most important reserve currencies in the world after the dollar. Consequently, the least sign of instability in the value of the dollar sets up

Table 5

Actual and Target Values of the Growth Rate of Central Bank Money

(Percent annual rates)

Period	Target	Actual
December 1974-December 1975	8.0	10.0
1976	8.0	9.2
1977	8.0	9.0
1978	8.0	11.4
1978Q4-1979Q4	6.0-9.0	6.3
1979Q4-1980Q4	5.0-8.0	4.9
1980Q4-1981Q4	4.0-7.0	3.6
1981Q4-1982Q4	4.0-7.0	6.1
1982Q4-1983Q4	4.0-7.0	7.0
1983Q4-1984Q4	4.0-6.0	4.6
1984Q4-1985Q4	3.0-5.0	4.5
1985Q4-1986Q4	3.5-5.5	7.7
1986Q4-1987Q4	3.0-6.0	8.1

speculative movements in the mark. In addition, a significant amount of world trade is invoiced in dollars.

The strong correlation between movements in the mark-dollar rate and how well the Bundesbank performed relative to its target range, in fact, allows us to divide the period under review into three sub-periods. The first covers the years immediately following the adoption of the CBM target, that is, approximately 1975 to 1979. The dollar tended to depreciate over this period and the Bundesbank generally allowed CBM to exceed its target.

The mark fell relative to the dollar over the first half of the 1980s. Over that period, CBM ended the year below the lower bound of its target range twice and was below the midpoint once. It never ended the year above the upper bound of its target range.

The last two years or so constitute the final sub-period, where the mark has been appreciating against the dollar again. And in both 1986 and 1987, CBM has grown above the target range. Thus, the target has been exceeded despite the fact that the Bundesbank increased the upper bound of the target range half a percentage point each year.

This is not to say that the Bundesbank cares only about stabilizing the exchange rate. As mentioned above (and described in the Appendix), the Bank is extremely concerned about price level stability. And the Bundesbank has from time to time, adjusted its policy stance to take the level of real activity directly into account. To obtain a more accurate idea of the importance that the Bundesbank attaches to various objectives, a monetary policy reaction function was estimated for the years 1975-1986.

The reaction function was estimated in terms of the deviation of CBM from the midpoint of the announced target path.[13] This variable — denoted by CBMDEV below — is preferable to using (either the level or the growth rate of) CBM directly, since using CBM may result in confounding the demand function for the aggregate with the Bundesbank's reaction function. The explanatory variables in the regression are the growth rate of real GNP (RGNP), the rate of inflation (GNPDEF), and the growth rate of the deutschemark-dollar exchange rate (DM$RATE), which is expressed in dollars per mark.[14]

The estimated equation is:

$$\begin{aligned}\text{CBMDEV}_t = {} & \underset{(2.96)}{1.52} + \underset{(.39)}{.01\ \text{RGNP}_t} \\ & \underset{(-.32)}{-\ .01\ \text{RGNP}_{t-1}} + \underset{(1.58)}{.05\ \text{RGNP}_{t-2}} \\ & \underset{(-1.32)}{-\ .03\ \text{RGNP}_{t-3}} - \underset{(-3.02)}{.18\ \text{GNPDEF}_t} \\ & \underset{(-3.32)}{-\ .19\ \text{GNPDEF}_{t-1}} + \underset{(.96)}{.006\ \text{DM\$RATE}_t} \\ & + \underset{(.62)}{.004\ \text{DM\$RATE}_{t-1}} \\ & + \underset{(.93)}{.005\ \text{DM\$RATE}_{t-2}} + \underset{(3.19)}{.02\ \text{DM\$RATE}_{t-3}}\end{aligned}$$

$R^2/\bar{R}^2 = .65/.53$; D.W. = 1.75; Rho = .58 (3.88)

From the test statistics, we can reject the null hypothesis that the coefficients on the current and lagged values of real GNP growth are zero at the 5 percent level of significance. However, the sum of the coefficients on real GNP is .02, and has a marginal significance level of .84. The coefficients on the inflation rate are significant at the 1 percent level, and their sum is −.37, which also is significant at the 1 percent level. We can reject the hypothesis that the coefficients of the current and lagged values of the exchange rate are zero at the 5 percent level of significance. The sum of these coefficients is .03 and is significantly different from zero at the 5 percent level as well.

These results are consistent with our earlier discussion. The estimates suggest that the Bundesbank responds immediately to changes in inflation. An increase in inflation leads to a contemporaneous reduction in CBM growth relative to the mid-point of its target range as well as a reduction in CBM growth over the next quarter. When the mark appreciates against the dollar, policymakers respond by pushing CBM above the midpoint of its target range. However, this response is slower than the response to inflation. Finally, the measured response to GNP is ambiguous. Thus, the Bundesbank apparently attaches the greatest importance to the rate of inflation and to stabilizing the exchange rate.[15]

We have examined how the Bundesbank sets its monetary targets and how successful it has been in attaining these targets. We saw that the target is missed fairly often, and that large misses are associated with variations in the dollar-mark exchange rate. These casual observations are supported by the results from the estimated reaction function.

However, the fact that the Bundesbank often gives up on its monetary target in pursuit of exchange rate stability has not called into question its commitment to price level stability. This appears to be the result of the relatively low rates of inflation that have prevailed in West Germany over the period. For example, Germany's GNP deflator increased by approximately 3 percent over 1986, after increases of approximately 2 percent over each of the previous two years. While the rate of inflation did go up following the 1979 oil price increase, the highest annual increase in the GNP deflator recorded since 1979 was the 4.8 percent inflation rate during 1981.[16] These relatively low rates of inflation imply that the Bundesbank's practice of giving up on its monetary target to focus on stabilizing the deutschemark has not imposed large costs in terms of price level stability. As a consequence, the Bank's anti-inflation stance remains credible.

V. Conclusions

This paper has focused on two aspects of the process of monetary targeting in Germany since 1975. The first concerns the choice of a target variable. Our results suggest that CBM has characteristics similar to the broad aggregate M3, and that neither is susceptible to the portfolio disturbances afflicting M1 and M2. We found evidence that the real value of CBM is cointegrated with real output and interest rates and (weaker evidence) that M3 is cointegrated with output. Cointegration between these variables allowed us to employ an error-correction specification to estimate demand functions for CBM and M3. These demand functions were robust to a simple test for nonstability. These results imply that both CBM and M3 satisfy the requirements for a target variable.

The finding regarding the nature of CBM has potentially important implications for the U.S. as well. Until recently, U.S. monetary policy has placed the most emphasis on the narrow monetary aggregate, M1. However, the behavior of M1 over the past few years has been largely at odds with the behavior of output and inflation. In fact, U.S. policymakers today are faced with a dilemma that is similar to that faced by West German policymakers during the mid-1970s. The policy of targeting the narrow aggregate M1 has been rendered infeasible by the increased substitutability between various types of deposit accounts both inside and outside M1.[17] While the broad aggregates M2 and M3 do not appear to have been as susceptible to the random portfolio disturbances that have afflicted M1 in recent years, movements in them are not likely to be closely related to movements in macroeconomic variables that are of interest to policymakers. As such, it may be useful to examine the relationship between output, inflation, and some aggregate similar to the West German Central Bank Money Stock with a view to obtaining a more suitable monetary target.

The second part of the paper examined the conduct of monetary policy in Germany since the Bundesbank began to target a monetary aggregate. The Bundesbank obviously places a great deal of emphasis on inflation. This is reflected in the estimated reaction function. It is also evident in the low rates of inflation in Germany over this period, rates that clearly have been lower than those that prevailed in most industrialized nations.

Germany's concern over inflation has not bound it to strict adherence to monetary targets, since the target has been missed frequently. Our finding of a stable CBM demand function suggests that the deviations from target are not due to "shifts" in the demand for CBM. Instead, the deviations demonstrate that the Bundesbank has retained a considerable level of discretion in the implementation of monetary targeting. Our examination of episodes of deviation from target shows that fluctuations in the exchange rate were a major determinant of where CBM ended up relative to its target. This practice has not had adverse effects on inflation because the Bundesbank has reacted symmetrically to increases and decreases in the value of the mark — easing when the mark tended to appreciate and tightening when it tended to depreciate.

APPENDIX

German Monetary Policy Since 1975

To provide greater insight into the discussion and conclusions in Section III, this appendix provides a brief description of German monetary policy since the Bundesbank began to target CBM.*

December 1974-December 1975

Monetary policy relaxed substantially in 1975, the first year that a target was announced. Real GNP had begun to contract in mid-1974 and fell by approximately 5 percent over the next four quarters. The Bundesbank's tendency to ease was reinforced early in the year by the falling dollar, which fell to the then-postwar low of 2.28 marks in March. When economic activity showed no sign of picking up by mid-1975, the Bundesbank eased policy even further. The discount rate stood at 3½ percent in September — half the level in September 1974.**

The monetary easing had the expected impact on CBM growth. The level of CBM in December 1975 was 10 percent above that in December 1974, or 2 percent above target. The Bundesbank responded to this overshooting by redefining the target year. The CBM target growth rate would henceforth be measured on a year-over-year basis, instead of December-over-December. The justification for dropping the old method was that it exaggerated the role of temporary factors. The targeted growth rate of CBM was set at 8 percent for 1976.

1976-1977

The economy rebounded over the next couple of years, while the rate of inflation declined. Domestic demand grew strongly in 1976 and real GNP increased by around 5.5 percent. The rate of inflation fell to 4 percent per year. Real GNP grew at a 2.5 percent rate the following year although unemployment did not fall much. Although the cost of living index for 1977 was 3.9 percent above 1976 levels, inflation was clearly slowing down over the course of the year.

The dollar, after recovering over mid-1975 and staying relatively stable over the first half of 1976, started falling against the mark in the second half. It fell throughout 1977, with the rate of depreciation accelerating considerably after October. On March 1, 1978 the dollar stood at 1.99 marks, having fallen 19 percent over the previous 14 months. The Bundesbank eased substantially over 1977, causing CBM to grow rapidly. CBM grew at a 12 percent annual rate over the second half of the year, but the 9 percent rate of growth for the year as a whole was just 1 percent above the target.

1978

The depreciating dollar was perhaps the most important reason behind the Bundesbank's maintaining its easy policy stance over 1978. Real GNP grew by 3.5 percent over the year and the rate of unemployment fell to 3.7 percent. Thus, the level of domestic activity suggested no need to ease. However, the mark was appreciating significantly against the dollar, so that by October 1978, the dollar stood at 1.78 marks. The attempt to stabilize the mark caused policy to remain accommodative, with the discount rate held at 3 percent over the year. This stance was facilitated by a still-declining rate of inflation — the 2.6 percent increase in consumer prices over 1978 was the lowest since the end of the 1960s. Easy policy did lead to a surge in CBM growth, with CBM growing 11 percent over the year, while the target rate was 8 percent.

The size of the miss appears to have been responsible for a redefinition of the target year once again, as the Bundesbank decided to target CBM growth on a fourth quarter over fourth quarter basis from the following year.

1979

The dollar-mark exchange rate was relatively stable over 1979. Accordingly, the Bundesbank focused on domestic conditions. Inflation was picking up gradually: while the cost of living index in 1979 was just 4.1 percent above 1978, its value in December 1979 was approximately 5.5 percent above year-ago levels. Economic activity was strong, with real GNP rising at a 4.5 percent rate and the unemployment rate averaging 3.3 percent.

The Bundesbank therefore tightened policy. The discount rate was raised to 4 percent in March and to 5 percent in July. CBM remained above target till May. At mid-year

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* *This description is not meant to be exhaustive. For a detailed discussion, see various issues of the OECD's Economic Surveys on Germany and the Bundesbank's Annual Reports.*

** *In Germany, the discount rate is not a penalty rate as it is in the U.S. Instead it is the rate at which commercial banks borrow against rediscount quotas established by the Bundesbank. For a description of policy instruments and operating procedures, see Deutsche Bundesbank (1982).*

the Bank decided to aim for the lower half of the CBM target range and policy was tightened further over the second half of 1979.

1980

A depreciating mark and rising inflation came together to determine the tight monetary policy stance that prevailed over 1980. Consumer prices were approximately 5½ percent above 1979 levels, while the mark fell by around 13 percent against the dollar. Although real GNP grew by nearly 2 percent over the year, this growth lay almost entirely in the first quarter, with output actually declining over the second half of the year. In February, the Bundesbank announced that it would keep CBM around the middle or perhaps in the lower half of its target range. Attempts to revive CBM growth, and thereby to increase real activity, during the summer were dropped when the mark began to depreciate. Signalling a continuation of its tight monetary policy stance, the Bundesbank reduced the target range for the next year by 1 percent.

1981

1981 was a year of contracting output and rising inflation. Real GNP fell 0.3 percent over the year, while the cost of living index rose by nearly 6 percent. The mark fell sharply against the dollar early in the year. By mid-February, it had fallen by about as much again as it did over all of 1980.

The Bundesbank reacted with a severe tightening of policy. The mark recovered in response and began to appreciate against the dollar in the latter half of the year. As a consequence, interest rates began to decline in late 1981. CBM growth was on target until mid-year but then slowed and actually declined for a while towards the end of the year.

1982

The worldwide recession in 1982 and the consequent decrease in German exports combined with stagnant domestic demand to cause a decline in real GNP of over 1.5 percent, while the unemployment rate rose from 5 to 6.5 percent. Although consumer prices increased by 5.3 percent during 1982, the pace of inflation was clearly slowing over the year. When the mark stabilized in early 1982, the Bank announced that CBM growth around the middle or in the upper half of the target range would be acceptable.

Monetary easing paused at mid-year as the mark fell against the dollar again. However, the worldwide reduction in interest rates towards the end of the year allowed German monetary authorities to ease domestic rates. The discount rate stood at 5 percent in December.

1983

The mark was relatively stable in early 1983 and the rate of inflation declined, allowing policymakers to focus on output growth. The Bundesbank indicated that, under these conditions, it would allow CBM growth in the upper half of its 4-7 percent target range over the year. Policy remained easy in the beginning, but the mark's depreciation later in the year led to a tightening of policy. Although the unemployment rate went up during 1983, the rate of output growth picked up over the course of the year. Real GNP increased by 1.5 percent over the year as a whole — the first increase since 1980.

1984

Real GNP grew by 2.5 percent in 1984, despite severe production losses due to strikes. Strong foreign demand contributed significantly to this increase. However, the unemployment rate stayed at 8.1 percent of the total labor force. Inflation continued on its downward trend as the cost of living index rose 2.4 percent compared to 3.3 percent in 1983. However, the mark fell by approximately 13.5 percent against the dollar over 1984, and this fall appears to have been largely responsible for halting the downward drift in interest rates.

1985

Interest rates actually increased around the time that the dollar peaked in February 1985. But the decrease in U.S. interest rates that followed triggered a marked decline in German interest rates as well. The upswing in real activity continued, with output growing at a 2.5 percent rate. Inflation slowed down further, with consumer prices increasing at a 2.2 percent rate over the year.

The upper bound of the CBM target range for 1984 had already been lowered to 6 percent on the grounds that the level of uncertainty about the economic environment had gone down. For 1985, the Bundesbank cited the prevailing low levels of inflation as the reason for lowering both the upper and lower bounds of the target range by 1 percent.

1986

The target range for 1986 was increased by half a percentage point on the grounds that the potential real output growth rate had increased. Prices were stable over the year, with some indices actually declining. Monetary

policy was dominated by the exchange rate again. The mark continued to appreciate against the dollar, and the Bundesbank responded with an accommodative policy. The discount rate was cut to 3.5 percent in March.

The accommodative policy stance was continued even when clear signs that CBM was overshooting its target emerged at mid-year. Thus, CBM growth for the 1986 target year was 7.7 percent, or more than 2 percentage points above the upper bound of the target range.

Uncertainty over the future course of exchange rates ("special uncertainties" in the Bundesbank's language) led to a widening of the 1987 target range by 1 percentage point.

Real output increased by 2.5 percent in 1986 due largely to an increase in consumption. However, growth began to slow from the middle of 1986, with production stagnating in the last quarter of 1986 and declining in the early months of 1987. The rapid deterioration was a surprise, being a consequence of sluggish exports and sharply increased import penetration. The volume of exports fell for only the third time in post-war history.

1987 on

Available data suggest that monetary policy continued to focus on the exchange rate over 1987. CBM grew 8.1 percent from the fourth quarter of 1986 to the fourth quarter of 1987, 2.1 percent above the 3.0-6.0 percent target range. In January 1988, the Bundesbank announced a 3-6 percent range for M3, citing the relatively large impact of (difficult to explain) currency movements on CBM as the reason for dropping that aggregate.

FOOTNOTES

1. Willms (1983) points out that the role played by the Central Bank Council in appointing new members has diminished over time, and that some members were appointed over the Central Bank's objections.

2. The West Germany definition of M2 is thus different from the U.S. definition. In the U.S., M2 contains M1, savings deposits, Money Market Deposit Accounts, Small Time Deposits (that is, time deposits containing up to $100,000), and some money market mutual funds.

3. See the discussion on pp. 71-82 of Deutsche Bundesbank, Special Series No. 7.

4. Deutsche Bundesbank, Special Series No. 7, p. 78.

5. Technically, we will be concerned with the existence of a "unit root." The simplest example of a process that contains a unit root is given by

$$y_t = y_{t-1} + u_t$$

where u_t is a stationary disturbance term. Such a process is called a random walk. This is a special case of a nonstationary process. For instance, the process

$$y_t = 2y_{t-1} + u_t$$

is nonstationary although it does not contain a unit root.

6. We look at the real values of the monetary aggregates because the objective is to estimate money demand functions in real terms. The GNP deflator has been used to convert nominal to real values.

7. Granger and Engle also present alternative tests for the null of no cointegration. One of these is the Augmented Dickey-Fuller test, which adds the lagged differences of the residual as additional right-hand-side variables to the regression used for the Dickey-Fuller test. The test statistic is the same as before. Results of this test are not reported here because the lagged differences of the residual were found to be insignificant.

8. For an earlier example of the use of an error-correction model to estimate a money demand function, see Hendry (1980). See also Motley (1988).

9. Splitting the sample into two equal sub-samples also does not suggest instability. For CBM, the computed F-statistic of 1.27 has a marginal significance level of .30. For M3, the F-statistic is .53, and has a marginal significance level of .75.

10. Needless to say, the Bundesbank's choice of CBM as the target variable has not been free from criticism. See, for example, Courakis (1980).

11. The following description is based on the discussions contained in various issues of the *Annual Report* of the Deutsche Bundesbank.

12. See the Bundesbank *Annual Report* for 1985.

13. Because the reaction function does not take into account the factors that go into setting the target ranges themselves, the results below are perhaps more appropriately interpreted as measuring the Bundesbank's response to unanticipated movements in output, the price level, and the exchange rate.

14. Since the explanatory variables are in growth rates, CBMDEV for a given quarter is actually measured as a percentage of the target level of CBM for that quarter. The estimated equation also contains a constant dummy for the second quarter of 1978 that is not shown below.

15. It should be pointed out that concern about the exchange rate ultimately does reflect concern about real GNP.

16. Since Germany is not an oil producer, the GNP deflator is not directly affected by oil prices. An alternative is to look at the Consumer Price Index. This index increased by 6.8 percent in 1981. The average rate over 1979-81 was 5.9 percent, while that over 1983-85 was 2.2 percent. The CPI fell by 1.1 percent over 1986.

17. See Judd and Trehan (1987) for a discussion of the recent changes in the behavior of various monetary aggregates in the U.S.

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Changes in Bank Risk-Taking

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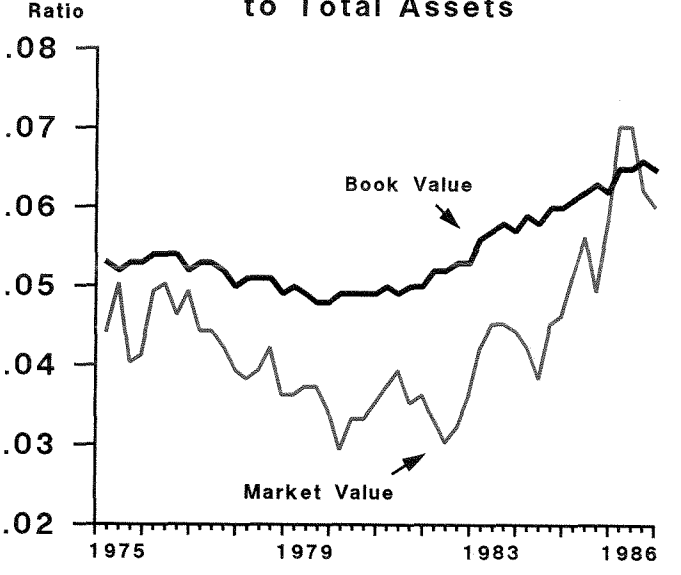
In the 1980s, two countervailing developments are evident among large bank holding companies — improvements in capital positions and increases in asset risk. Empirical evidence presented in this paper indicates that the net effect has been to increase the default risk of large bank holding companies and to raise the risk exposure of the deposit insurance system. The findings, however, do not support the view that the requirement to raise capital to meet minimum capital standards in the 1980s contributed to greater risk-taking among large BHCs.

Capital positions among large bank holding companies improved dramatically during the 1980s. Chart 1 shows that the average ratio of book value, primary capital to assets for 98 of the largest publicly traded bank holding companies (BHCs) rose from about 4¾ percent in 1980 to about 6½ percent in 1986[1] The rise in capital ratios was even more remarkable when measured in terms of market values.[2]

From a regulatory perspective, this decrease in bank leverage represents a positive development since it should serve to reduce default risk among the banking institutions and to protect the deposit insurance system, everything else equal. Default risk and the liability of the insurance system, however, also depend on the degree of asset risk assumed by banking organizations. This is relevant, since in the 1980s, the problems associated with energy loans, real estate loans, and lending to lesser developed countries, as well as higher volatility in financial markets likely have contributed to greater asset risk for banks. Thus, greater asset risk may have offset part or all of the beneficial effects of the higher levels of bank capital.

Chart 1
Primary Capital to Total Assets



Changes in capital regulation in the 1980s also may have raised bank asset risk indirectly. In December 1981, the bank regulatory authorities announced the imposition of the first explicit minimum capital-to-asset ratios for banks and BHCs. These requirements, which became effective in mid-1982, were amended in 1983 and again in 1985.[3] The new capital requirements had the effects of making the minimum requirements uniform for virtually all banks and BHCs and of increasing regulatory capital requirements for those BHCs with relatively low capital-to-asset ratios at the beginning of the decade.

The shift to uniform minimum capital standards has raised the concern that they may have had the unintended side-effect of allowing more asset risk for banks in general. This worry was expressed by the Federal Reserve in its 1986 proposal for new risk-based capital standards, which were said to be needed "to temper the disincentives inherent in the existing guidelines to hold low-risk, relatively liquid assets."

Another concern is that the BHCs that were required to raise their capital ratios to meet higher capital standards may have reacted by increasing asset risk.[4] This view of the effect of capital regulation can be found in a number of academic studies as well as in the popular press (see Furlong and Keeley, 1987a, for a discussion of the articles maintaining this view). Their implication is that BHCs forced by regulation to raise capital would be expected to increase asset risk relative to the other BHCs.

Purposes

The purposes of this paper are to examine empirically the change in asset risk among the large BHCs in the 1980s, and to evaluate the net effects of the improvements in capital positions and changes in asset risk on the default risk of large BHCs and on the risk they pose to the deposit insurance system. The paper also investigates whether changes in asset risk, default risk, and the value of the deposit insurance subsidy were different for those BHCs required to increase capital ratios to satisfy the new regulatory standards during the 1980s than for the BHCs that already met the minimum standards at the start of the decade.

The rest of the paper is organized as follows. Section I presents opposing views on how higher regulatory capital requirements would be related to the incentives for banks to take risk. Section II presents empirical evidence that asset risk rose among large bank holding companies between 1981 and 1986. That section also offers evidence suggesting that the rise in bank asset risk has more than offset the benefits from higher capital ratios, resulting in a rise in default risk among the large BHCs and an increase in the risk they present to the deposit insurance system. Section III provides a summary and conclusions.

I. Views on Bank Asset Risk

In recent years, attention focused on how a bank's decisions regarding asset risk are affected by the current system of fixed-rate deposit insurance premiums. Several studies have shown that, with fixed-rate deposit insurance, the value of a bank's equity is positively related to the riskiness of its assets as well as its degree of leverage.[5] That is, the value of a bank increases as the bank shifts to more risky assets and as it increases leverage (reduces its capital-to-assets ratio). Under these circumstances, if leverage were constrained by regulators, a value-maximizing bank would be expected to hold the most risky asset portfolio permitted under bank regulation.

With underpriced deposit insurance, therefore, much of the burden of constraining asset risk among value-maximizing banks would fall on the regulatory authorities. In principle, for asset-risk regulation to be effective, regulators must impose costs on a bank that violates the regulations that are at least equal to the gains the bank realizes from increasing asset risk. Thus, developments that mute the regulatory response to risk-taking would tend to foster more asset risk.

One such development may have been the adoption of uniform minimum capital standards for banks and BHCs in the 1980s. The application of explicit, uniform capital ratios could have hindered the process through which judgmental adjustments are made by bank examiners as to the amount of capital required of banks and BHCs with different asset portfolios. That is, the explicit minimum ratio may have limited the extent to which required capital ratios have been adjusted upward to compensate for higher asset risk.

As stated earlier, one reason given by the regulatory authorities for wanting to switch from the current uniform minimums to risk-based capital requirements is that the latter standards, in principle at least, would vary automatically among banking institutions according to the degree of asset risk. Without such systematic adjustments, it is possible that a bank meeting the capital standards now

may be able to hold a riskier portfolio than it previously could at the same degree of leverage. Under these circumstances, and with the system of fixed-rate deposit insurance premiums, asset risk in banking can be expected to rise.

Another critical question in the regulation of asset risk in banking is how a bank's incentives to take on asset risk are affected by changes in the stringency of capital requirements. The traditional argument is that higher capital standards lead to more asset risk because banks that are required to increase capital will shift to higher yielding, riskier assets to increase the rate-of-return on equity. For example, Kahane (1977) and Koehn and Santomero (1980) claim to show that, within a two-parameter Markowitz portfolio model, more stringent capital requirements would cause a utility-maximizing bank to increase asset risk. Unfortunately, their models do not hold for value-maximizing banks, for which the liability exposure of the deposit insurance system is especially relevant. Moreover, it has been shown in a previous issue of this *Review* (Furlong and Keeley, 1987a),[6] that these studies have internally inconsistent models and that their results cannot be used to support their claims.

There are other arguments, however, that suggest that higher capital requirements could lead to banks holding more risky combinations of assets.[7] James (1987), for example, shows that higher capital requirements on new investments can exacerbate an underinvestment problem. That is, an institution faced with raising relatively more capital to fund new projects would tend to forego certain low risk ventures in which it might otherwise invest. The implication is that the resulting asset portfolio would tend to be smaller and include relatively more risky assets than if capital requirements were lower.

While the possibility that higher capital requirements can lead to greater asset risk cannot be ruled out, it certainly can be shown that increases in regulatory capital requirements do not have to lead banks to take on more asset risk. Given that a bank has incentives to increase asset risk owing to the presence of mispriced deposit insurance, Furlong and Keeley (1987b) show that the effect of a given change in asset risk on the value of a bank is negatively related to a bank's capital-to-asset ratio. That is, with underpriced deposit insurance, the marginal gain to a bank from increasing asset risk declines as its capital position increases.[8]

This finding implies that regulatory constraints on asset risk sufficient to restrain a bank at a given level of leverage also would be sufficient at any lower level of leverage. The conclusion to be drawn from this view of banks and bank regulation is that higher capital requirements should not lead to greater asset risk.

The validity of the last statement depends on the assumption that regulatory constraints are not eased. This is an important qualification since, as stated earlier, the issue is whether, for a given level of leverage, a bank meeting capital standards now may be able to hold a riskier portfolio.

II. Empirical Results

This section empirically investigates changes in risk-taking in banking between 1981 and 1986. Evidence is presented first on how asset risk among a sample of large BHCs changed over this period. Then, changes in default risk, which is related to both the asset risk and the leverage of an institution, among the sample of large BHCs is examined along with the change in the risk these BHCs pose for the deposit insurance system. This section also studies whether the requirement for a BHC to raise its capital-to-asset ratios to meet the new regulatory requirements in the 1980s was related to the BHC's changes in asset risk and default risk.

BHC Sample

The basic sample of institutions considered consists of 98 large, publicly traded BHCs with financial data available on the Compustat tapes for the years 1975 to 1986. Among this set of institutions, about one-fourth had book value, primary capital-to-asset ratios that were below the minimum standards announced by the regulatory authorities in December 1981. The minimum primary capital standard announced in 1981 for most BHCs with $1 billion or more in assets was 5 percent.[9]

When the minimum capital ratios were set in 1981 the majority (two-thirds) of the large BHCs with primary capital ratios below the minimum were multinational holding companies. Technically, the minimum standards did not apply to the multinational institutions. Nevertheless, the multinational BHCs were under regulatory pressure to increase capital ratios, and it is reasonable to assume that the BHCs anticipated that they eventually would be subject to the formal minimum standards. Indeed, by June 1983, the multinationals were subject to the same minimum capital standards that applied to other holding companies with assets of $1 billion or more. In 1985, the minimum primary capital ratio for all BHCs was set at a uniform 5½ percent.[10]

Since one of the issues to be investigated is whether being required to increase its capital ratio after 1981 affected the risk assumed by a BHC, the institutions not meeting the 1985 minimum primary capital requirements on average during 1981 are identified as the BHCs that should have been most directly influenced by the higher capital standards. In the basic sample of 98 institutions considered, 24 are classified as not meeting the capital requirements. For convenience of presentation, these 24 institutions are referred to as the "capital-deficient BHCs," and the other institutions in the sample are referred to as either "capital-sufficient BHCs" or "other BHCs."

Changes in Asset Risk

In finance theory, asset risk commonly is represented by the variation in the economic rate-of-return on assets. Specifically, asset risk is assumed to be positively related to the variability of the return on assets. Following this approach, the analysis of asset risk in this paper focuses on the standard deviation of the return on assets as the appropriate measure of risk. In addition, since the regulatory authorities have expressed specific concern over a shift by institutions away from low-risk, liquid assets, changes in the relative holdings of such assets among the sample of large BHCs also are reviewed.

The problem posed by using the standard deviation of the return on assets in an empirical analysis of changes in risk is that the variation in the economic (market value) rate-of-return on assets is not observable. Fortunately, it can be estimated from other "observable" variables. This is done in another study related to risk in banking, by Ronn and Verma (1986).

Using the results from Black and Scholes (1973), Ronn and Verma represent the equity value of a banking organization as a call option on the value of its assets. The argument for doing so is that the debtholders can be thought of as effectively owning the assets of a firm and giving the stockholders the option to buy the assets back at maturity (under the assumption the maturities of assets and liabilities are equal). At maturity, the value of the equity (the option) would be the difference between the value of the assets and the face value of the liabilities if that difference were positive, and zero otherwise.

In this model, the exercise price is equal to the face value of the bank's debt at maturity, and the option would be exercised by the stockholders only if the value of the assets were to exceed that of the liabilities. If the value of the liabilities were to exceed the value of the assets at maturity, the stockholders would not exercise the option and, in effect, would allow the debtholders to keep the assets.

Given that most, if not all, bank debt is either explicitly or implicitly federally insured to some degree, the deposit insurance system is in effect the primary creditor of banks. For this reason and for simplicity, we assume that the maturity of the equity call option is related to the renewal period of the insurance guarantee, which is assumed to be once a year, at a known date.

With this simplification, the Black-Scholes option pricing formula applied to the equity of a BHC is

$$E = A\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A}\right) - D\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A} - s_A\right) \qquad (1)$$

and

$$s_A = \frac{E}{A\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A}\right)}\, s_E \qquad (2)$$

where

- E = market equity,
- A = market assets,
- D = the current face value of the bank's debt,
- s_A = standard deviation of the rate-of-return on market assets,
- s_E = standard deviation of the rate-of-return on market equity, and
- $N(x)$ = the standard normal cumulative density function evaluated at x.

Of the variables in equations 1 and 2, only equity can be observed directly. To reduce further the number of unknown variables in the system, it is assumed that the market's evaluation of s_E, which in the context of the model is made *ex ante* and assumed to be constant over the one-year life of the option contract, is based on the past value of the standard deviation of the return on equity. The specific assumption used is that the option contract is set just prior to the beginning of a calendar year, and the value of s_E is equal to the standard deviation of the return on equity for the previous twelve months. With this assumption, E and s_E can be treated as known parameters in the equation system.[11] That leaves a system of two equations and two unknowns, A and s_A, that can be solved simultaneously using a numerical approximation technique.

This approach was followed to derive two sets of estimates for s_A and A for each BHC using data for the years 1981 and 1986. The year 1981 is the year before the new capital standards were imposed and before the general rise

in bank capital positions, while 1986 is the last full year for which data are available. Equity, E, is estimated using the sum of the market value of common stock and the par value of preferred stock at the end of each year. The estimate of the standard deviation of the return on equity, s_E, is derived using the monthly stock price data for each year.

The top row of Table 1 presents the average of the standard deviations of the rates-of-return on assets for all the BHCs in the sample for each year, as well as the change in the averages. From 1981 to 1986, the increase in the average standard deviation is statistically and economically significant. Over that period, the measure of asset risk doubled.[12]

The bottom portion of Table 1 presents evidence on the change in asset risk for the two subgroups, the capital-deficient and the capital-sufficient BHCs (other BHCs). For both groups, the increase in asset risk was substantial and highly significant. However, the change in the average of the standard deviations of the rates-of-return on assets for the two groups is not statistically significant. That is, the increase in asset risk was not greater for the BHCs with low capital-to-asset ratios that were forced by regulatory authorities to raise their capital ratios after 1981, compared to the BHCs that satisfied the requirements in 1981.

While the variation in the return on assets is an appropriate measure of asset risk, as pointed out earlier, regulatory authorities have expressed specific concern over banks shifting away from low-risk, liquid (or marketable) assets — that is, they have been concerned with a decline in such assets relative to total assets. From the Compustat data, the items that might be included in the category of low-risk, liquid assets include vault cash, interbank deposits (due from banks), and reserves held with the Federal Reserve as well as Treasury and agency securities.

The argument for focusing on these assets is that, all else equal, the lower the relative holdings of assets with little or no default risk, the higher the overall risk of assets. This line of reasoning, however, is not necessarily valid. The net impact on an institution from increasing or decreasing a given type of investment has to be evaluated in terms of the composition of the institution's overall asset portfolio — that is, it has to take into account the covariances in the returns on assets, as does the variation of the return on total assets.

Recognizing the limitations of using the relative holdings of liquid assets as an indicator of asset risk, Chart 2 shows that the average of the ratios of these assets to total assets declined markedly for both groups of BHCs after 1981. This evidence is consistent with the finding of an increase in asset risk in Table 1. It also tends to support the regulatory authorities' concern that banks have shifted away from assets with low default risk under the capital standard adopted in 1981.

Table 1

Asset Risk

(Standard deviation of the estimated rate of return on market value assets)

	Mean standard deviation		Difference
	1981	1986	1986-1981
All BHCs	0.010	0.020	0.010* (10.49)
Capital-deficient BHCs	0.007	0.016	0.009* (2.07)
Other BHCs	0.012	0.021	0.009* (9.49)
Difference	−0.005* (3.26)	−0.005* (3.20)	0.000 (0.02)

Absolute value of t-statistics in parentheses.

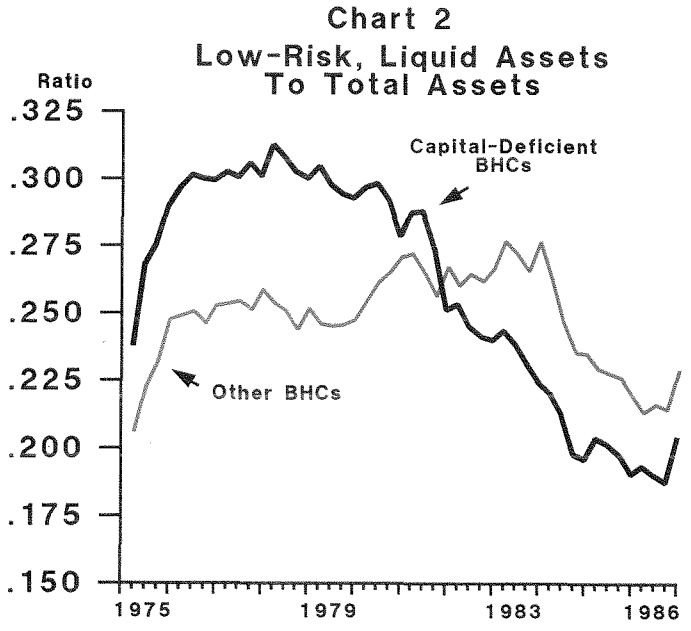
** Significant at the 95 percent level or higher.*

However, other factors could account for this decline in the ratios of low-risk, liquid assets to total assets. Other causes seem likely because it is evident from Chart 2 that the decline in the average ratio for the capital-deficient BHCs was under way prior to 1981.

Another observation from Chart 2 is that the decline in the average ratio between 1981 and 1986 is larger for the capital-deficient BHCs than for the other BHCs. A separate comparison of the changes in the ratios reveals that the difference is statistically significant. However, based on the evidence in Table 1, the larger drop in the relative holdings of liquid assets with little or no default risk does not seem to have resulted in a larger increase in overall asset risk for the capital-deficient BHCs.[13] The last observation points up the potential danger of evaluating the risk of an institution based on a subset of its assets in isolation from the rest of its portfolio.

Default Risk

The preceding evidence indicates that asset risk has increased substantially since 1981. However, over this same period, the capital positions of the BHCs in the sample also increased sharply (Chart 1). The greater asset risk and the reduced leverage would have opposite effects on the overall risk or default risk of the BHCs. From a regulatory perspective, an important question is: what has been the net effect on the default risk among the BHCs and the liability they impose on the federal deposit insurance system? To answer this question, we first present evidence on the change in default risk and then turn to the related issue of the change in the risk exposure of the deposit insurance system.



One approach to evaluating the default risk of an institution is presented in Boyd and Graham (1986) and Wall (1985). This approach uses an indicator that is related to the probability of failure, which in turn is a function of the variation in income and the capital position of an institution. Specifically, an institution fails when losses exceed capital. That is,

$$\text{Probability of failure} = \text{Probability}(\text{profits} < -\text{E}). \quad (3)$$

Dividing both terms of the inequality in the parentheses by E, the probability of failure can be expressed as being equal to the probability that the rate-of-return on equity, r_E, is less than negative one,

$$\text{Probability}(r_E < -1). \quad (4)$$

Assuming that the return on equity is distributed as a normal random variable, and standardizing the terms in statement 4, the probability of failure is equal to

$$\text{Probability}((r_E - \bar{r}_E)/s_E) < z) \quad (5)$$

where $\bar{r}_E$ is the expected rate-of-return on equity and

$$z = (-1 - \bar{r}_E)/s_E. \quad (6)$$

The variable z then is the standard normal variate, representing the number of standard deviations the rate-of-return would have to fall below its expected value for the bank to fail. To be consistent with the other studies that have used this measure of default risk, we will use the negative of z and denote it as Z. Thus, higher Z-values indicate a lower probability of failure.[14]

To test for changes in default risk, Z-values were estimated for each bank in the sample for the two years 1981 and 1986. One difference between the Z-values derived in this study and those calculated in other studies is that in this study the Z-values are based on estimates of the market values of the returns on equity and the standard deviations of the returns on market equity, rather than on book value measures.[15] The expected return on equity was estimated using the average market return on equity in each year for each institution. The standard deviations of the returns on equity are the same as those used in the calculations for Table 1.

The top portion of Table 2 shows that the mean value of Z for the overall sample of BHCs was significantly lower in 1986 than in 1981. The lower value of Z indicates a higher

probability of failure. This means that the increase in asset risk more than offset the decrease in leverage, and thus led to higher default risk on average.

The bottom portion of Table 2 reveals that, on average, the default risk did increase for the capital-deficient BHCs. However, for that group of BHCs, the change in Z was not significantly different from zero. For the other BHCs, the value of Z did decline on average and the decline is significant. Default risk, then, did not increase more among the BHCs that were required to increase capital after 1981 than among the other BHCs. In fact, as reflected by the changes in the Z-values, the default risk was not significantly lower for the capital-deficient group compared to the other BHCs in 1986, whereas the difference between the two groups of institutions was not significant in 1981.

Deposit Insurance System Risk

As a complement to the evidence on the changes in Z-values, estimates of the change in the risk exposure of the deposit insurance system between 1981 and 1986 can be used to evaluate the net effect of the rise in asset risk and the decrease in leverage. Merton (1977) shows that the deposit insurance guarantee can be modeled as a put option. Building on Merton's model of a Black-Scholes put option and assuming an examination interval of one year, Ronn and Verma (1986) express the value of the insurance guarantee per dollar of deposits as

$$I = N\left(\frac{ln\left(\frac{D}{Ad}\right) - \left(\frac{s_A^2}{2}\right)}{s_A} + s_A\right) - d\left(\frac{A}{D}\right) N\left(\frac{ln\left(\frac{D}{Ad}\right) - \left(\frac{s_A^2}{2}\right)}{s_A}\right). \quad (7)$$

With the exception of I, which is the per dollar of deposit value of insurance, and d, which is one minus the dividend rate relative to assets, all the other variables in equation 7 are found in equations 1 and 2.

In this expression of the value of the deposit insurance guarantee (equation 7), the face value of the debt at maturity represents the exercise price.[16] The bank can be thought of as choosing to exercise the put option (sell the assets to the insurance system) if, at the end of the insurance guarantee period (assumed to be one year), the face value of the debt were greater than the value of the assets. Whereas, if the value of assets were higher – that is, equity were positive, the bank can be thought of as not exercising the put option and holding on to the assets.

Using the estimates for the unobservable variables, A and s_A, from solving equations 1 and 2, and the estimates for the other variables from the Compustat data, equation 7 was evaluated for each BHC in the sample using data for 1981 and 1986. In using the calculations from equation 7 to estimate the value of deposit insurance, certain assump-

Table 2

Default Risk

	Mean Z-Value		Difference
	1981 data	1986 data	1986-1981
All BHCs	4.925	3.758	−1.167* (5.41)
Capital-deficient BHCs	4.413	3.549	−0.865 (0.72)
Other BHCs	5.108	3.832	−1.276* (5.11)
Difference	−0.695* (2.02)	−0.283 (0.82)	0.411 (0.85)

Absolute value of t-statistics in parentheses.

** Significant at the 95 percent level or higher.*

tions are being made. It is implicitly assumed that regulators applied the same closure or insurance renewal rule in both time periods: to close institutions found to have negative market capital at the scheduled examination. Different closure rules would generate different estimates of the value of deposit insurance, and, more important for the purposes of this paper, affect the estimates of the changes in the value of deposit insurance.

Given these restrictive assumptions concerning the closure rule, the results in Table 3 should be viewed with caution, particularly with regard to the estimates of the levels of the value of the insurance guarantee. As it stands, the evidence concerning the changes in I is roughly consistent with that on default risk. The mean value of I for all BHCs in the sample is significantly higher using the data for 1986 than that based on the data for 1981. Using the maximum statutory deposit insurance premium for banks, $.0008 per dollar of deposit, as a benchmark, the estimates in the top portion of Table 3 indicate that, on average, deposit insurance was overpriced in 1981 under the assumed closure rule. Likewise, the estimates based on the data for 1986 indicate that, on average, deposit insurance was overpriced for the sample of BHCs.[17]

These results are consistent with the idea that the increase in asset risk more than offset the benefits from the decline in leverage among the BHCs, and left the deposit insurance at greater risk at the end of 1986 than at the end of 1981. However, just like the results in Table 2, the findings reported in the bottom portion of Table 3 do not allow us to reject the hypothesis that the increase in the mean value of I was the same for both groups of BHCs, since the difference between changes for the two groups is not significantly different from zero.

III. Summary and Conclusions

This paper examines changes in asset risk, default risk, and the liability of the deposit insurance system for a sample of large BHCs between 1981 and 1986. For the sample, asset risk increased substantially. This increase in asset risk appears to have been large enough to offset the effects of improved capital positions among the sample institutions between 1981 and 1986. On average, the estimates of default risk among the sample institutions and the risk the institutions present to the deposit insurance system increased significantly. These findings tend to justify concerns that there has been an easing of combined capital and asset risk standards in banking. That is, institutions appear to be holding riskier assets relative to leverage.

Table 3

Deposit Insurance System Risk

(Estimated value of deposit insurance per dollar of deposit)

	Mean per dollar of deposit value of insurance		Difference
	1981 data	1986 data	1986-1981
All BHCs	2.42×10^{-6}	2.61×10^{-5}	2.37×10^{-5}* (1.79)
Capital-deficient BHCs	3.04×10^{-6}	3.60×10^{-5}	3.30×10^{-5} (1.26)
Other BHCs	2.19×10^{-6}	2.25×10^{-5}	2.04×10^{-5} (1.31)
Difference	8.52×10^{-7} (0.04)	1.35×10^{-5} (0.63)	1.26×10^{-5} (0.42)

Absolute value of t-statistics in parentheses.

* *Significant at the 93 percent level.*

The paper also considers the issue of whether BHCs forced to raise capital to meet the new minimum capital standards increased asset risk and default risk by more than other bank holding companies. The capital-deficient BHCs did tend to make larger cuts between 1981 and 1986 in their relative holdings of liquid asset with little or no default risk and (as discussed in the Appendix) showed somewhat bigger increases in loan loss reserves ratios. Despite this development, however, the evidence on the change in the variation of the return on assets indicates that, on average, the BHCs required to raise primary capital did not increase asset risk by more than the BHCs that were relatively well capitalized in 1981. In addition, between 1981 and 1986, there was no significant difference in the change in the estimates of the per dollar of deposit value of the deposit insurance for the capital-deficient BHCs compared to that for the other BHCs. The results in this paper, then, do not support the view that increases in regulatory capital standards lead banks to increase asset risk.

APPENDIX

Loan Loss Ratios as Measures of Asset Risk

Another risk measure often employed in empirical studies focuses on the "quality" of an institution's loan portfolio. That measure of loan risk is the ratio of loan loss reserves to total loans (LLR). The usual justification for using this measure is that an institution with higher risk loans would be expected to have a higher value of LLR[1]

To the extent that loan loss reserve ratios can be compared among banks, the plots in the chart point to a general deterioration in the quality of loans among the sample of BHCs. Moreover, after 1984, it is evident that the rise in LLR was noticeably larger for the capital-deficient BHCs. Separate computations show that the difference in the changes in the ratios for the two groups between 1981 and 1986 is statistically significant, suggesting a greater increase in asset risk among the capital-deficient BHCs.

However, as discussed in the text in connection with Table 1, the evidence on the change in the variation in the return on market assets does not show a significant difference in the increase in overall asset risk for the two groups of BHCs. A possible explanation for the difference in the behavior of LLR for the two groups in the sample in recent years is that the ratios have been affected by off-balance sheet credit extensions or loan sales, and, thus, may not accurately reflect the differences in risk associated with the lending activities of the BHC's. One reason this seems possible is that the greater rise in LLR for the capital-deficient BHCs in the 1980s was due to much slower growth in on-balance sheet loans among those BHCs than among the other BHCs, and not to a more pronounced pick-up in the growth of loan loss reserves.

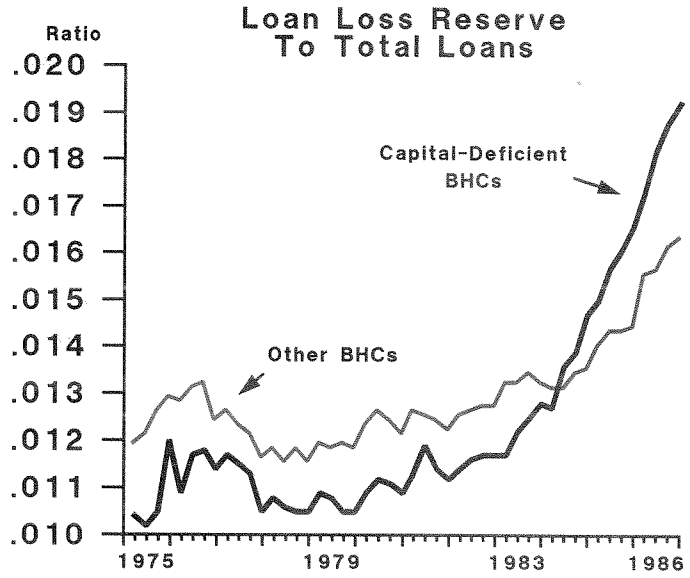
Whether the loan loss reserve ratios adequately reflect differences in the quality of assets connected with credit extensions depends in part on what accounts for the slowdown in the accumulation of loans at the capital-deficient BHCs. Take the most relevant off-balance sheet activity, standby letters of credit (SLCs), for example. To the extent that a bank uses SLCs as an alternative to direct lending, its volume of on-balance sheet loans would be less. Since SLCs generally are issued to higher quality bank borrowers (see James, 1987), the quality of the remaining on-balance sheet loans for a bank issuing SLCs should be lower on average. When compared only to on-balance sheet credits, then, the loan loss reserve ratio should be higher the greater the use of SLCs by a bank. However, the quality of the on-balance sheet loans are not representative of the bank's credit exposure via SLCs, and, thus, as SLCs grow, the loan loss reserve ratio can overstate the deterioration in quality of a bank's effective credit extensions.

The problem presented by SLCs is that they tend to lead to an overstatement of a bank's book value capital position. This is because the minimum capital standards are expressed only in terms of on-balance sheet assets and capital, and the enforcement of capital regulation does not always fully compensate for SLCs. A bank then could use SLCs effectively to increase leverage and overall risk, even if the risk of its combined on- and off-balance sheet assets were unchanged.

In contrast, if a slowing in loan growth at a bank were related to loan sales, a rise in loan loss reserve ratios would not necessarily be a distortion. Once again, the sales of loans would be expected to involve higher quality bank loans.[2] With loans sold without recourse not included on a bank's balances, the average quality of the bank's credit extensions could fall. Thus, a higher loan loss reserve ratio would be indicative of the difference in the quality of the bank's loan portfolio, everything else the same. However, while the bank's assets might be riskier, the sale of loans could lead to a reduction in leverage, which would tend to offset the adverse effects of higher asset risk.

It is not certain, then, what a higher loan loss reserve ratio that stems from slower loan growth means for the risk

of a bank's combined on- and off-balance sheet assets. And, the implications for the default risk of an institution are blurred since slower loan growth can have implications for leverage as well as for loan loss reserve ratios. With SLCs present, loan loss reserve ratios tend to overstate asset risk but understate book value leverage. In contrast, loan sales lead to higher loan loss ratios but can be used to reduce leverage, and, thereby, default risk.



1 *One complication encountered when relating this measure of risk to capital requirements is that loan loss reserves are themselves included in regulatory capital. Given that there are tax advantages from allocating earnings to loan loss reserves, a bank attempting to build up capital through retaining earnings would be expected to make the maximum possible contributions to loan loss reserves.*

2 *See James, 1987.*

FOOTNOTES

1. For regulatory purposes, primary capital for BHC's includes common equity, loan loss reserves, minority interests in equity accounts of consolidated subsidiaries, net mandatory convertible securities, perpetual preferred stock, and perpetual debt subordinated to the interests of depositors.

2. Market value of primary capital is estimated by the sum of the market value of common equity and the book value of preferred equity.

3. For a description of the change in capital requirements, see Gilbert, Stone and Trebling (1985).

4. Keeley (1988), shows that capital positions among large BHCs improved appreciably on a book value as well as on a market value basis in the 1980s. The results of that study also suggest that the imposition of the new capital requirements contributed to the general improvement in bank capital positions by raising capital-to-asset ratios at those BHCs with relatively low ratios at the beginning of the 1980s.

5. See for example Dothan and Williams (1980), Sharpe (1978), Kareken and Wallace (1978), Merton (1977), Pyle (1984), and Furlong and Keeley (1987a, b).

6. See also Keeley and Furlong, 1987.

7. Outside the academic literature, a common argument for why capital regulation will affect the asset risk of a bank assumes that bank managers are constrained to meet a target rate-of-return on equity. In this instance, a bank reacts to capital regulation by shifting to investments with higher expected yields to maintain a predetermined rate-of-return on equity. Such behavior would imply a shift to a more risky asset portfolio, given the usual tradeoff between asset yields and risk.

Although apparently widely held, this view of the reaction of banks to capital requirements implicitly assumes that banks do not engage in optimizing behavior because, on the margin, banks ignore the tradeoff between asset risk and return on equity.

8. This result can be shown formally by adapting a Black-Scholes put option formula to the deposit insurance guarantee along the lines of Merton (1977). This is done in Furlong and Keeley (1987b), which shows that the second derivative of the option value of deposit insurance with respect to asset risk with respect to leverage is positive. For a graphic presentation of the effects of leverage on the gains from risk-taking, see Furlong and Keeley (1987a).

9. For BHCs with less than $1 billion in assets, the minimum primary capital ratio was set at 6 percent in 1981. Minimum ratios for total capital were set at 5½ percent for BHCs with $1 billion or more in assets (excluding 17 multinational BHCs) and a 6½ percent for the smaller BHCs. (See Gilbert, Stone, and Trebling, 1985).

10. In 1985, the minimum total capital ratio was set at 6 percent for all BHCs.

11. Ronn and Verma also attempt to include in their model a regulatory closure policy in which a bank with a deficiency in capital equal to or less than a certain fraction of total debt is given financial assistance and not closed. For the estimates in this paper, it is assumed that a bank discovered to have negative capital upon examination is closed without financial assistance to the stockholders.

12. In the context of the model, the values of s_A derived using the data for 1981 and 1986 represent estimates of the market's ex ante evaluation of the standard deviations of the return on assets of the BHCs for the years 1982 and 1987 respectively.

13. The Appendix discusses another commonly used indicator of asset risk, the ratio of loan loss reserves to total loans. The change in this indicator between 1981 and 1986 for the sample of BHCs in this study points to a general rise in loan risk. The change in the loan loss reserve ratio was larger for the capital-deficient BHCs. However, from the evidence in Table 1, this does not appear to have led to a relatively longer increase in overall asset risk. The Appendix discusses how difference in off-balance sheet credit extension could possibly account for the difference in the changes in loan loss reserve ratios for the capital-deficient and the capital-sufficient BHCs.

14. In computing the Z-values, it is assumed that regulators always close a bank when the bank is found to have negative net worth upon examination. To the extent that banking organizations are allowed to operate with negative market net worth, the Z-values would tend to overstate the chances an institution would be closed by regulators.

15. Under this approach the observed equity is assumed to represent the true measure of protection to liability holders. In general, this is not the case with book value measures of capital.

16. The exercise price is $X = De^{rt}$, the face value of the organization's debt at the time of the examination, which is assumed to be one year — that is, $t = 1$. The term r is the rate paid on bank debt, which is assumed to be the risk-free interest rate.

17. Estimates from Marcus and Shaked (1984) for a smaller sample of BHCs show that deposit insurance was overpriced, on average, in 1979 and 1980. Ronn and Verma show that the value of the insurance guarantee depends on the closure rule applied by regulators. Using a less stringent closure rule than the one assumed in this paper, Ronn and Verma report results for which the average per dollar of deposit value of the insurance guarantee was about equal to .0008 in1983. This would imply that, using the rule of closing banks when equity is discovered to be zero upon examination, the Ronn and Verma results would show deposit insurance to be overpriced on average. As in these other studies, the estimates used in this paper for the value of the insurance guarantee show that it varies considerably among the institutions in the sample.

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