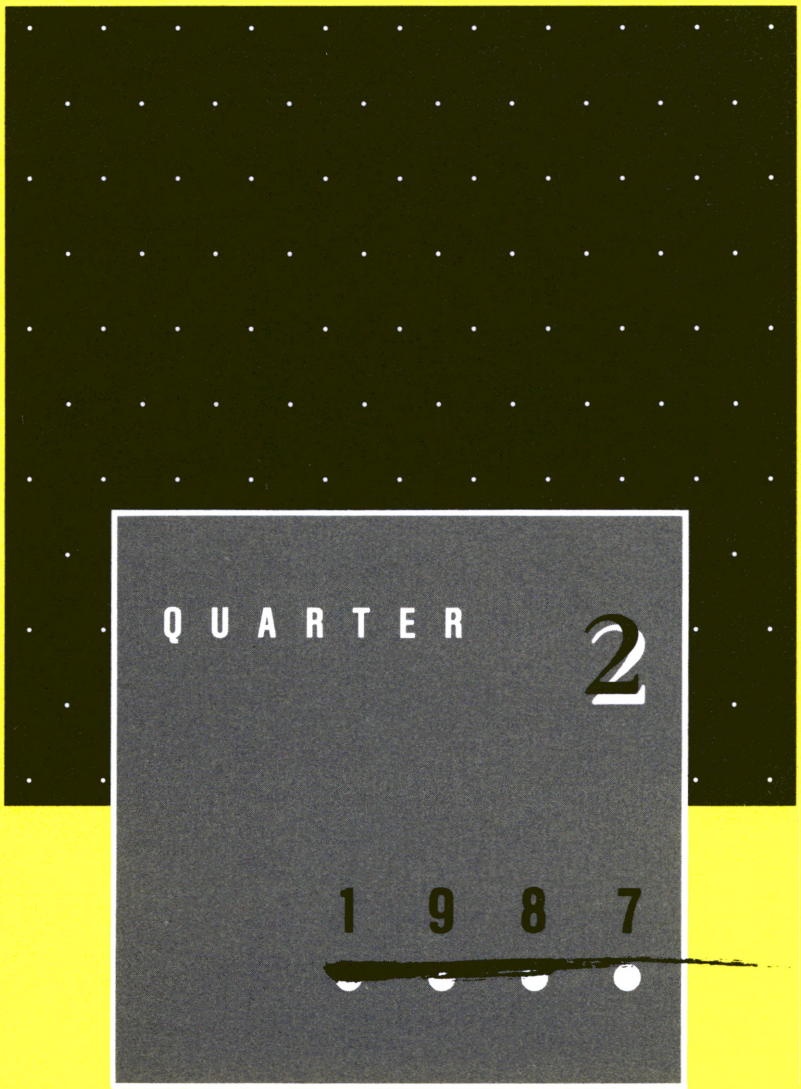
ECONOMIC REVIEW



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A New Effective Exchange Rate Index for the Dollar and Its Implications for U.S. Merchandise Trade

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Introduction

One of the most critical problems facing our economy today is the unprecedented size of the foreign-trade deficit. The rapid growth of imports relative to exports since 1980 has been blamed for curtailing the rate of economic expansion in recent years, and is symptomatic of the deteriorating position of some U.S. industries in world markets. Recognition that the trade deficit must be reduced has led to calls for protectionist legislation, as well as to official efforts aimed at encouraging more stimulative economic policies among our trading partners. For the most part, though, hopes for improving the trade imbalance have rested with the depreciation of the dollar in foreign-exchange markets over the past two years.

Since early 1985, the dollar has depreciated sharply against the individual currencies of a number of our major trading partners, with the Japanese yen and the currencies of Europe being the most notable examples. By and large, most conventional measures, or indexes, of the dollar's *average* foreign-exchange value are built around this group of currencies. Hence, the unprecedented cumulative depreciation of the dollar relative to these particular currencies formed the basis for widespread predictions that the U.S. balance of trade would improve dramatically in 1986 and 1987.

Unfortunately, a significant improvement in the U.S. balance of trade has yet to materialize. This failure has prompted analysts and policymakers alike to reexamine their interpretations of how far the dollar's average value against a broad group of foreign currencies has fallen during the past two years. The result has been the emergence of a variety of new measures of the dollar's average value in foreign-exchange markets.

For the most part, the newer indexes have two common characteristics. First, they include a broader group of foreign currencies than the more conventional measures, which, for the most part, are built on the currencies of Japan, Europe, and Canada. Second, as a result of the additional currencies they include, the newer measures show much less depreciation in the dollar since early 1985 than the conventional measures depict. The implicit conclusion from these newer indexes, then, is that the U.S. trade balance is not likely to improve as much as might have been expected.

While the efforts at constructing new, broader indexes of the dollar have shed much light on how the dollar's foreign-exchange value has been changing, a number of important questions remain unanswered. The first set of questions involves the specifics of how an index measuring the dollar's average foreign-exchange value should be constructed. The second set has to do with evaluating the usefulness of the indexes for explaining and predicting trade flows. The purpose of this article is to address both sets of questions.

Our analysis is presented as follows. In part I, a new trade-weighted effective exchange-rate index is constructed in both nominal and real terms. The index differs from the traditional indexes by including currencies of more of the United States' principal trading partners (including

several that recently have become more important U.S. trade partners), and by updating the weights. Any index must be judged by how well it serves the purpose for which it was constructed. We built our index to help explain and predict prices and volumes of U.S. imports and exports. We have found that our index is as good as, and probably better than, the other indexes we tested for these purposes for the time periods that we examined.

Part II develops a model of U.S. merchandise trade that is designed to capture the effects of changes in the value of the dollar on U.S. export and import prices and quantities. We use this model to compare the usefulness of our exchange-rate index to others in predicting trade prices and quantities, and to show that the magnitude of predicted changes in trade flows is significantly affected by how the dollar index is constructed.

I. Trade-Weighted Effective Exchange Rate Indexes for the Dollar

The Dollar and U.S. Trade: An Overview

One of the more important determinants of U.S. trade flows is the foreign-exchange value of the dollar. An increase in the dollar's nominal foreign-exchange value raises the foreign currency price of U.S. goods sold abroad, and lowers the dollar price of foreign goods sold in the United States. Over time, then, an appreciation of the dollar would be expected to worsen the U.S. balance of trade by lowering foreign demand for U.S. exports and by raising the U.S. demand for foreign goods. A depreciation of the dollar works in the opposite direction, and would be expected to improve the U.S. balance of trade.

A key issue in assessing the impact of changes in the dollar's foreign-exchange value on U.S. trade flows is determining which measures of the dollar and trade to employ. The United States trades many different types of goods and services with a large number of countries, and the dollar's foreign-exchange value can be expressed in terms of any number of more than 150 foreign currencies. While there are many possible versions of the definition of trade flows and the dollar, it is clear that the specific measure of the dollar's foreign-currency price that is selected ought to be motivated by the nature and breadth of trade flows being investigated. For example, in explaining the effects of a change in the dollar's foreign-exchange value on the flow of certain manufactured goods between the United States and Japan, the most appropriate measure of the dollar may simply be its price relative to the Japanese yen. However, when the scope of analysis is broadened to include additional countries, or a greater variety of goods, a more encompassing measure of the dollar is needed.

Most broad-based inquiries into the relationship between the dollar and trade are built around U.S. exports and imports of merchandise to and from the rest of the world, and a trade-weighted effective-exchange-rate index.[1] Trade in services is excluded primarily for two reasons. First, the U.S. trade deficit is the result of an overwhelming imbalance in the merchandise component. In 1986, for instance, the total real-trade deficit was about $148 billion.[2] Of that total, the balance for trade in services was a surplus of nearly $33 billion, while the balance for trade in merchandise was a deficit of just over $181 billion. Consequently, the balance of trade in services has not been high on the agenda of policy concerns. Second, trade in services does not tend to be as responsive to the same set of determinants as trade in merchandise is, particularly when it comes to the exchange rate.[3]

Typically, the exchange-rate index used to explain trends in merchandise trade is, or resembles, one of the well-established indexes, such as the Federal Reserve Board's (FRB), the Morgan Guaranty Trust Company's (MG), or the International Monetary Fund's (IMF).[4] These aggregative measures of the dollar were developed largely in response to the deterioration in the early 1970s of the fixed exchange-rate regime, which was finally abandoned altogether in March 1973. As the dollar's value began to change by varying degrees and in different directions against individual foreign currencies, the need arose for a summary measure, or index, of the dollar's average foreign-currency price.

For the most part, the conventional indexes were built around a group of currencies that were freely convertible, used frequently in international transactions and investments, and from countries that were important trading partners of the United States. These considerations narrowed the group to the currencies primarily of Japan, Canada, and countries in Europe.

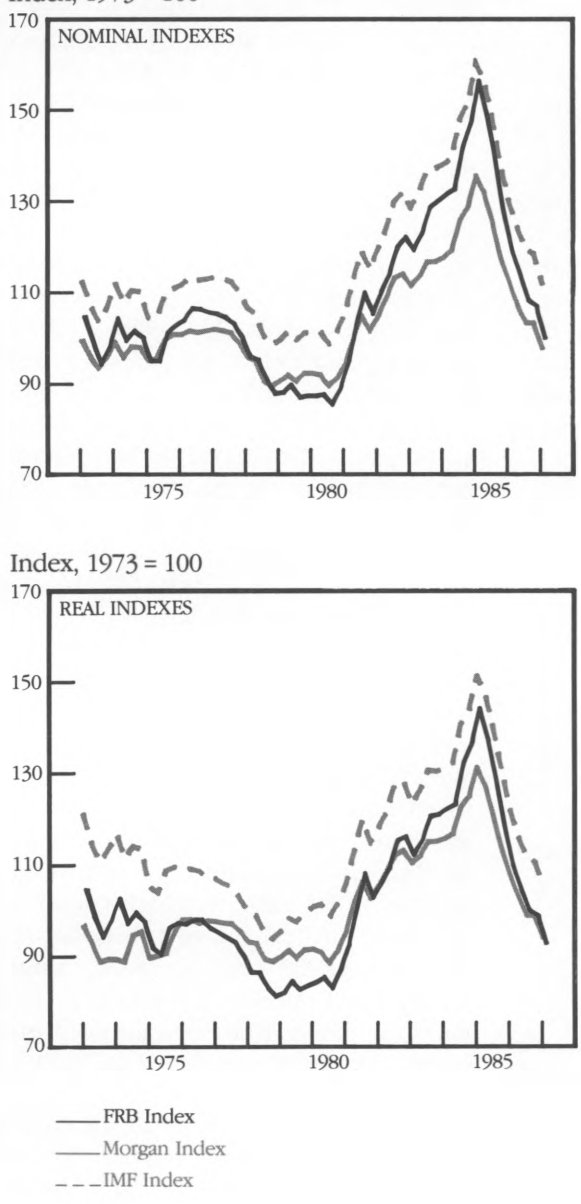
1 Examples of this type of study include Rude (1986), Feldman (1984), and Hooper (1976).

2 The figures for the real trade deficit and its components are on a national income and product account basis, in 1982 dollars.

3 For evidence, see Proctor (1982).

4 The Federal Reserve Board index is published in the *Federal Reserve Bulletin*. The Morgan Guaranty index is published in *World Financial Markets*. The International Monetary Fund index is published in *International Financial Statistics*. For a more detailed description of the composition of these particular indexes, see Belongia (1986).

Nominal and Real Trade-Weighted Dollar Indexes



NOTE: Real FRB and IMF indexes are FRBC estimates.
SOURCES: Board of Governors of the Federal Reserve System; *International Financial Statistics*, International Monetary Fund; *World Financial Markets*, Morgan Guaranty Trust Company.

FIGURE 1

While the FRB, MG, and IMF indexes differ somewhat in the details of their construction, each has come to represent the standard profile of the dollar's foreign-exchange value (figure 1).

The heightened concern over the relationship between the dollar and merchandise trade stems from the dramatic changes each has gone through during the past six or seven years. As measured by the indexes in figure 1, the dollar has gone through two sharply distinct phases since 1980. The first phase was a period of unprecedented cumulative appreciation from mid-1980 to early 1985. The second phase, which began immediately thereafter, has been marked by a fairly continuous and rapid rate of depreciation. Although the rates of change measured by each index differ somewhat, the proportion of depreciation from 1985:Q1 to 1986:Q4 to appreciation from 1980:Q3 to 1985:Q1 indicated by each is virtually the same. In nominal terms, the ratio is about 70 percent, while in real terms, it is nearly 75 percent.[5] Put differently, according to conventional measures, the bulk of the dollar's appreciation from mid-1980 to early 1985 has been offset by its depreciation since then.

The merchandise trade balance has also changed significantly since 1980. Unfortunately, the change has been a fairly steady and substantial deterioration in both current and constant dollars, even when imports of petroleum and petroleum products are excluded (figure 2). When petroleum imports are included, the deterioration since mid-1980 is even more pronounced.

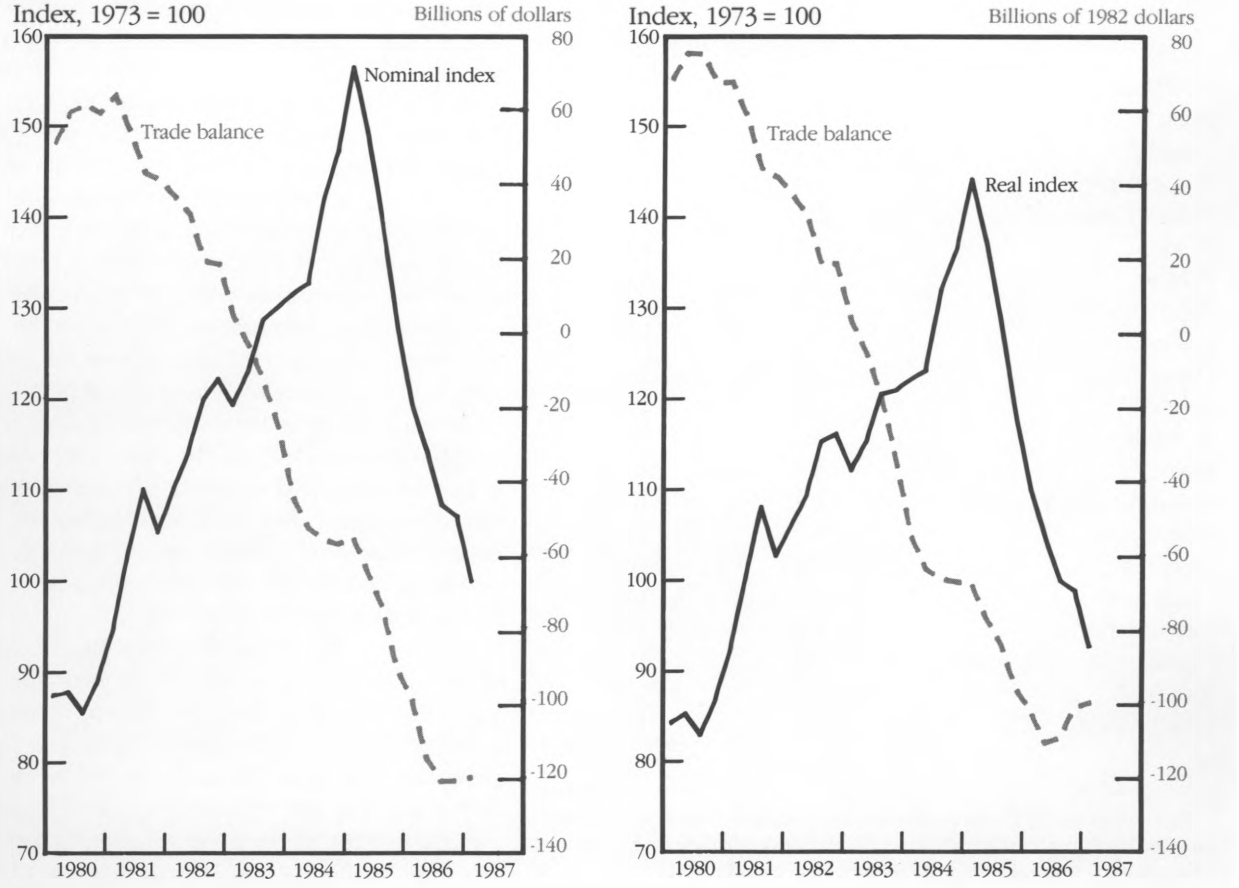
In nominal terms, the merchandise trade balance excluding petroleum imports, as illustrated in figure 2, fell from a surplus of $61 billion in 1980:Q3 to a deficit of $122 billion in 1986:Q4. In real terms, the decline was from a surplus of $75 billion to a deficit of $102 billion, equivalent to 3 percent of real gross national product (GNP). Perhaps more importantly, though, during the period corresponding to the dollar's depreciation from 1985:Q1 to 1986:Q4, the trade balance deteriorated almost $67 billion in nominal terms, and nearly $34 billion in real terms. To be sure, the slight uptick towards improvement in 1986:Q4 and 1987:Q1 is encouraging. Whether it is the beginning of a small, short-lived improvement, or of a more sizeable, long-term improvement in the real merchandise trade balance, though, is far from clear. This question represents one of the key issues confronting the U.S. economy.

The failure of the trade balance to improve significantly up to now in response to two years of sharp dollar depreciation has been a source of disappointment and concern to policymakers and economists. Just as the dollar's appreciation was a major factor behind the decline of U.S. net exports from 1980:Q3 through 1985:Q1, the dollar's depreciation since then was expected to bring about noticeable gains in the trade balance.[6] Moreover, the anticipated increase

5 For each index, the ratio of depreciation to appreciation was calculated as the first difference in the index level from 1985:Q1 to 1986:Q4 divided by the first difference in the index level from 1980:Q3 to 1985:Q1. Calculating the ratio in this manner avoids the distortion of comparing a rate of appreciation measured off a low index value to a rate of depreciation measured off a much higher index value.

6 For a discussion and empirical assessment of the effects that dollar appreciation had on the merchandise balance of trade, see Feldman (1984).

Federal Reserve Board Index and the Merchandise Trade Balance Excluding Petroleum



NOTE: Real FRB index is FRBC estimate.
SOURCES: Board of Governors of the Federal Reserve System; U.S. Department of Commerce; Bureau of Economic Analysis, NIPA.

FIGURE 2

in net exports has been counted on heavily to compensate for a likely negative fiscal stimulus resulting from the Gramm-Rudman-Hollings initiative to reduce the federal budget deficit. In fact, many private forecasts for the U.S. economy for 1986 and 1987 predicted that roughly half of the increase in real GNP (Q4/Q4) would come from an increase in real net exports.[7]

A number of explanations have been offered as to why the trade deficit has yet to improve significantly. First, the response of exports and imports to a decline in the dollar involves time lags that are said to be longer than previously estimated. Second, other determinants of trade, such as slow income growth abroad relative to growth in the United States, have worked to worsen the balance of trade and have outweighed the positive effects of dollar depreciation. Third, foreign exporters have maintained the competitiveness of their goods in U.S. markets by cutting their profit margins to offset the price effects of the dollar's decline.[8] Finally, the rate at which the dollar has depreciated since early 1985 has been significantly overstated by conventional exchange-rate indexes.

While each of these explanations has some degree of merit, the latter one, regarding how far the dollar has depreciated, has received the greatest attention. For the most part, it has come in the form of challenges to the standard profile of how the dollar's average foreign-exchange value is measured. The main criticism levied against the conventional measures is that they exclude the currencies of a number of countries—principally the newly industrialized countries (NICs) of Asia—whose share of trade with the U.S. over the past decade has been increasing. By excluding these currencies, the conventional indexes continue to calculate the dollar's average foreign-currency price primarily in terms of the currencies of Japan,

7 For example, see DRI (December 1985) and DRI (December 1986).

8 For further discussion of ways that foreign exporters have reduced or delayed the impact of dollar depreciation on import prices, see Anderson and Carlson (1987).

Countries in the FRBC Trade-Weighted Dollar Index

Country	Percent of U.S. World Trade[1] In 1974	In 1984
Japan*	13.7%	17.2%
Canada*	15.8	14.9
W. Germany*	7.0	5.6
United Kingdom*	5.3	4.7
Mexico	5.1	4.6
Taiwan	2.2	4.2
Republic of Korea	1.9	3.3
France*	3.2	3.0
Hong Kong	1.6	2.4
Italy*	2.9	2.4
Netherlands*	3.1	2.2
Brazil	3.0	2.2
Belgium/Luxembourg*	2.4	1.7
Singapore	0.9	1.6
Australia	2.0	1.5
Saudi Arabia	0.5	1.2
Switzerland*	1.2	1.2
China, People's Republic	0.6	1.1
Sweden*	1.1	1.0
South Africa	1.1	1.0
Total	74.6%	77.0%

* Included as one of the 10 countries in the Federal Reserve Board's trade-weighted dollar index. Overall, these 10 countries accounted for 55.7 percent of total U.S. world trade in 1974 and 53.9 percent in 1984.

1. Merchandise exports, plus nonpetroleum merchandise imports, minus auto trade with Canada.

Source: Federal Reserve Bank of Cleveland.

TABLE 1

Canada, and Europe, a group whose aggregate share of U.S. trade has been declining over the past 10 to 15 years and that accounts for little more than half of U.S. trade (table 1).

Of course, if the dollar had been changing by about the same degree relative to the excluded currencies as it has been relative to the included currencies, then the exclusions would be unimportant, at least so far as the standard profile of dollar depreciation and its potential effects on the merchandise trade balance are concerned. However, since 1985:Q1, the dollar has fallen by very little, if at all, against the excluded currencies, while it has fallen sharply relative to almost all of the included ones. For example, between 1985:Q1 and 1986:Q4, on an inflation-adjusted basis, the dollar depreciated by 37 percent, 36 percent, 35 percent, and 24 percent against the currencies of Japan, Germany, France, and Britain, respectively, but fell only 4 percent against the currency of Taiwan and actually rose 4 percent, 2 percent, and 3 percent against the currencies of Korea, Hong Kong, and Singapore, respectively (figure 3).

The outcome of the challenge to the standard profile of how the dollar's foreign-exchange value is calculated has been the emergence of a host of new exchange-rate indexes. The common elements among them are expanding the set of currencies to include those of the United States' emerging trading partners, and updating the weights by which each currency's relative importance in the index is determined.

According to these newer indexes, the dollar has depreciated considerably less over the past two years than the conventional indexes show. This result carries with it two particularly important policy implications. One is that the improvement to the trade balance over the near term is likely to be considerably less than is expected by those analysts who are relying on the conventional indexes. The other implication is that much of the upward price pressures associated with dollar depreciation still lie ahead because less of the dollar depreciation that is needed to redress the trade balance has been achieved than many analysts realize.

To address the criticisms of the conventional dollar indexes and the shortcomings of some more recent indexes, we have constructed a new exchange-rate index for the dollar. Our purpose was to create an index that would be more useful than the others for the purpose of explaining and forecasting price and volume changes of U.S. imports and exports. The construction of our index is explained in the following section.

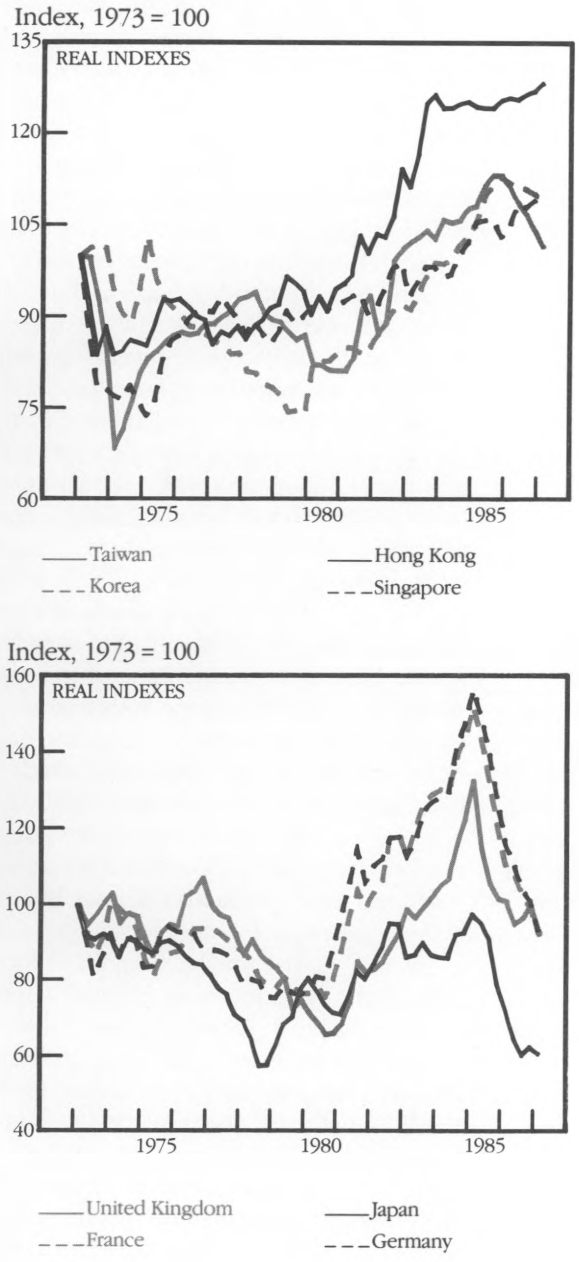
The Federal Reserve Bank of Cleveland (FRBC) Exchange-Rate Index[9]

An exchange-rate index provides a summary value of the dollar's price relative to other foreign currencies. There are four general features that distinguish one exchange-rate index from another. First is the set of currencies it includes. Second is how, and over what time period, the weight, or relative importance, assigned to each currency is calculated. The third feature involves the technique employed to derive the weighted average of the dollar's foreign-exchange value. The final feature is the price used to deflate each of the individual currencies if the index is expressed in real as well as in nominal terms.[10]

9 For convenience of exposition, the dollar index constructed in this paper is hereafter referred to as the Federal Reserve Bank of Cleveland (FRBC) index. This designation does not imply endorsement by the Federal Reserve Bank of Cleveland or by the Board of Governors of the Federal Reserve System.

10 For a more complete discussion of the issues involved in the construction of an effective exchange-rate index, see Rhomberg (1976).

Changes in the Dollar Against Selected Currencies
Foreign Currency Units Per Dollar



NOTE: Real indexes are deflated using CPI values.
SOURCES: *International Financial Statistics*, International Monetary Fund; Board of Governors of the Federal Reserve System.

FIGURE 3

The most important feature of any exchange-rate index may well be the currencies it includes. As indicated earlier, most conventional indexes are built around currencies from Europe, Canada, and Japan. The FRB measure of the dollar incorporates the currencies of eight European countries, plus Canada and Japan. The MG index uses the same 10 currencies as the FRB index, and adds four more European currencies, as well as Australia's. Finally, the IMF's index includes the same 15 currencies as the MG index and adds two more European currencies.

In contrast to the well-established indexes, the new FRBC index takes the FRB index as a point of departure and adds the currencies of Australia and the next nine most-important trading partners of the United States.[11] Included in this group of nine are a number of NICs such as Taiwan, the Republic of Korea, Mexico, and Brazil. The 20 countries included in the FRBC index are listed in table 1.

Several points regarding selection of these countries relative to the currencies included in the Federal Reserve Board index are worth raising. First, together they account for a far-greater share of U.S. merchandise trade—77 percent vs. 54 percent. Second, they reflect the general shift in U.S. trade since 1974 away from Europe and towards Asia (countries other than Japan). While Taiwan, Korea, Hong Kong, Singapore, and the People's Republic of China accounted for about 7.2 percent of total U.S. merchandise trade in 1974, their share had grown to 12.6 percent by 1984. Third, Mexico and Brazil, who together make up nearly 7 percent of U.S. merchandise trade, are also included. While these two countries are usually excluded from conventional nominal-exchange-rate indexes because of their high rates of inflation, their inclusion may nevertheless paint a more revealing picture of the dollar in real terms.

A second important aspect of an effective exchange-rate index is the manner in which each currency's relative significance, or weight, is determined. The standards by which significance is measured can vary, but significance typically is based on shares of trade. In general, there are three types of trade-related weights.

The first type, bilateral weights, emphasizes trade between two countries. A country's weight is equal to its total trade with the United States (exports, plus imports) expressed as a share of total U.S. trade with all countries included in the index. The second type, multilateral weights, is typically calculated on the basis of each country's share of the total world trade of the countries included in the index. Finally, there are trade weights that could be derived from a general equilibrium model of world trade. In theory, these weights are preferred since they can account for unique trade structures, price elasticities, feedback effects, and competition in third

11 From here on, the Federal Reserve Board's effective exchange-rate index is used to represent the broader group of well-established, or conventional, indexes of the dollar's foreign-currency price.

markets. In practice, though, general equilibrium model weights are extremely complicated to formulate and implement.[12]

The debate over whether bilateral or multilateral weights are preferable is ongoing. The argument most often raised in favor of multilateral weights is that they capture 'third market' or 'third country' effects, whereas bilateral weights do not. For example, a country that may not be an important direct trading partner with the United States can still affect U.S. trade to a significant degree via its trade with other countries or in other markets in which the United States competes. Such a country's currency might be given a small weight or even be excluded from a bilateral index, but it is given greater recognition in a multilateral index.

But while a multilateral index captures third-country effects, it may do so at the expense of introducing some important biases. First, multilateral weights can overstate the third-market effect by assigning large weights to countries that conduct a great deal of trade with each other, but not with the United States. Moreover, such trade relationships can have more to do with political factors than with economic factors. Second, multilateral weights tend to understate the importance of currencies of countries that are important trading partners with the United States, but that have a small share of world trade. Both of these features of multilateral weights can result in misestimating the exchange rate's impact on U.S. trade or inflation, especially in the short run.

In this study, we have used bilateral weights. In this regard, construction of the FRBC dollar index is similar to that of the Morgan Guaranty index, but not to the Federal Reserve Board index, which uses multilateral weights.

The years from which the weights are calculated should accurately reflect the composition of U.S. trade, while avoiding years in which exogenous factors played a dominant role in shaping the patterns of trade.[13] The weights in the FRBC index were calculated as an average of bilateral trade shares in 1983 and 1984. These years were chosen because they were not recession years and because they were the most recent years for which complete trade data were available.

Of course, in calculating trade weights, the issue of what types of trade the index should reflect must be addressed. Since our study is concerned primarily with assessing exchange-rate impacts on merchandise trade, the trade in services that a foreign country has with the United States is excluded from the calculation. In addition, since a portion of U.S. trade with Canada involves intra-automobile-industry transactions that seem to depend primarily on factors other than the value of the U.S. dollar relative to the Canadian dollar—such as the production and sales of domestic autos in the United States—Canada's relative weight is reduced by excluding its automotive imports from and exports to the United States (see Rude [1986]). Finally, U.S. imports of petroleum and petroleum products were excluded from each foreign country's share of trade with the United States because these goods are priced in dollars and are generally regarded to be unresponsive to changes in dollar exchange rates.

Because an index is an average of several components, some method must be used to calculate that average. Both geometric averaging and arithmetic averaging methods have been used to construct dollar indexes. The geometric method is used for our index because it avoids some bias that can result from the arithmetic method.[14]

We have constructed nominal and real or price-adjusted indexes. For the latter, we have used the consumer price index in each country as a proxy for inflation.

The weights assigned to each currency in the FRBC index are presented in the last column of table 2. These weights differ from the trade shares presented in table 1 partly because they are an average for 1983 and 1984 instead of just 1984, but mostly because the shares have been scaled up so they will total 100 percent. Given our purposes for constructing an effective exchange-rate index, and the weighting scheme we have chosen, the Federal Reserve Board's measure appears to understate the importance of the yen and Canadian dollar and to overstate the importance of the mark. Moreover, the currencies of the 10 additional countries included in the FRBC index have, in effect, a weight of zero in the Federal Reserve Board index, even though those countries account for about 23 percent of U.S. merchandise trade.

The differences in weights for currencies between the two indexes have an important bearing on how each index measures changes

12 The IMF multilateral exchange-rate model (MERM) attempts to measure trade weights in a more general equilibrium world-trade model.

13 There is no generally accepted method for choosing a base year. As Belongia (1986) points out, it ought to be one in which absolute purchasing power parity holds, and countries included in the exchange-rate index consume identical commodity bundles. Unfortunately, this standard has little practical application, because the latter condition never exists.

14 For a discussion of the advantages that the geometric averaging technique has over the alternative arithmetic method, see Deephouse (1985) or the *Federal Reserve Bulletin* (August 1978) p. 700.

Foreign Currency Weights in Alternative Trade-Weighted Effective Exchange-Rate Indexes (in percent)

Country	Model-Based Weights	Multilateral Weights			Bilateral Weights
	IMF Index[1]	FRB Index[2]	FRB, Updated[3]	FRB, Updated and Expanded[4]	FRBC Index[5]
Japan	21.3%	13.6%	17.4%	13.4%	21.9%
Canada	20.3	9.1	9.6	7.4	19.1
W. Germany	13.0	20.8	19.4	15.0	7.1
United Kingdom	5.1	11.9	11.7	9.0	6.2
France	10.1	13.1	12.1	9.3	3.9
Italy	7.5	8.3	9.3	7.2	3.2
Belgium/Luxembourg	2.4	6.4	6.4	5.0	2.3
Netherlands	3.2	8.3	7.6	5.9	3.1
Sweden	2.7	4.2	3.3	2.5	1.3
Switzerland	1.7	3.6	3.3	2.5	1.7
Taiwan				2.3	5.5
Republic of Korea				2.6	4.3
Hong Kong				2.4	3.1
China, People's Republic				2.2	1.5
Singapore				2.4	2.1
Mexico				1.6	5.8
Brazil				1.9	2.6
Saudi Arabia				3.8	2.0
South Africa				1.6	1.3
Australia	4.9			2.1	2.0
All Other Europe	7.9				
	100%	100%	100%	100%	100%

1. The currency weights are from the exchange-rate index in the International Monetary Fund's Multilateral Exchange-Rate Model. They are calculated from 1977 data.
2. The currency weights are from the Federal Reserve Board exchange-rate index. They are calculated as average weights from 1972 to 1976.
3. This set of currency weights is derived in exactly the same manner as those in the Federal Reserve Board's published index, except that they are calculated by the authors as averages from trade flows in 1983 and 1984.
4. The currency weights in this index are derived in exactly the same manner as those in the Federal Reserve Board's published index, except that they are calculated by the authors as averages from trade flows in 1983 and 1984 across an expanded set of countries.
5. The currency weights in the Federal Reserve Bank of Cleveland exchange-rate index are derived from each country's average bilateral trade shares with the U.S. in 1983 and 1984, excluding Canada's auto trade with the U.S. and each country's petroleum exports to the U.S.
Sources: Federal Reserve Bank of Cleveland; Federal Reserve Board, *Federal Reserve Bulletin;* International Monetary Fund, *International Financial Statistics, Supplement on Exchange Rates.*

TABLE 2

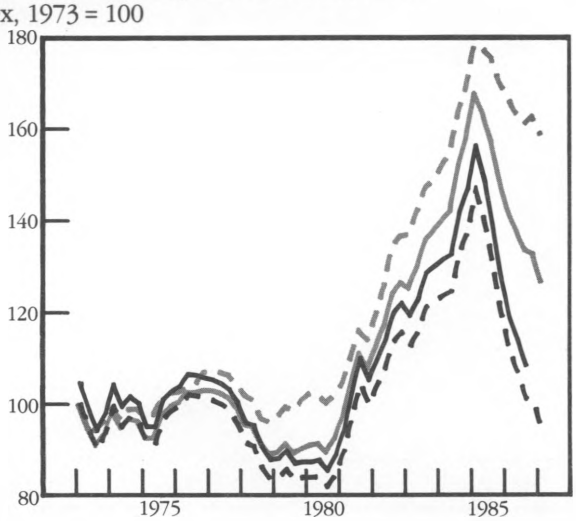
in the value of the dollar. To a certain extent, overstating the influence of the German mark, while understating the influence of the Japanese yen, constitutes offsetting errors since both currencies have appreciated by approximately the same percentage since February 1985. But the Canadian dollar has remained virtually constant vis-a-vis the U.S. dollar since then. Furthermore, the currencies of Hong Kong, Singapore, and Korea have depreciated slightly against the dollar in real terms since February 1985, while the currency of Taiwan has appreciated only slightly (figure 3).

Table 2 also shows the weights for two additional indexes that are intermediate between the Federal Reserve Board index and the FRBC index. One, which we call the FRB Updated index, in the third column, has the same 10 countries as the Federal Reserve Board index with weights calculated by the Board's method, but for trade flows in 1983 and 1984. The other, which we call the FRB Updated and Expanded index, expands the Federal Reserve Board index list of 10 countries to the FRBC index list of 20 countries, with weights calculated by the Board's method, but for trade flows in 1983 and 1984.

The consequences of how the FRBC index was constructed, for interpreting the dollar's value against other currencies, are striking. Compared with the Federal Reserve Board's index, for example, the FRBC index captured the general nominal appreciation of the dollar during the first half of the 1980s, but suggests that the

depreciation since then has been much less (figure 4). Between 1980:Q3 and 1985:Q1, the Federal Reserve Board measure of the dollar appreciated more than 83 percent. At the same time, the FRBC measure rose by over 78 percent. However, from 1985:Q1 to 1986:Q3, while the Federal Reserve Board index depreciated by about 30 percent, the FRBC index indicates that the dollar depreciated by only 9 percent, and that depreciation offset considerably less of the dollar's previous appreciation.

Nominal Trade-Weighted Dollar Indexes
Index, 1973 = 100



——Board, 10 currencies, multilateral weights
– – –Board updated, 10 currencies, multilateral weights
——Board updated and expanded, 20 currencies, multilateral weights
– – – FRBC, 20 currencies, bilateral weights

SOURCES: Board of Governors of the Federal Reserve System; Federal Reserve Bank of Cleveland.

FIGURE 4

A better way to compare the movements in the indexes is to compare the proportion of the appreciation from 1980:Q3 to 1985:Q1 that was offset by the depreciation from 1985:Q1 to 1986:Q3. The Federal Reserve Board index indicates a 68 percent offset, but the FRBC index indicates that only 22 percent was offset.

There are also sharp differences when both indexes are measured in real terms (figure 5). From 1980:Q3 to 1985:Q1, the Federal Reserve Board's measure of the dollar, adjusted for inflation, rose by almost 74 percent while the FRBC index appreciated by 43 percent. Since then, however, the Federal Reserve Board's measure shows depreciation of more than 27 percent in real terms, while the FRBC real measure of the dollar fell by less than 13 percent. In terms of proportions, the Federal Reserve Board index indicates that 72 percent of the appreciation was offset while the FRBC index indicates that only 56 percent was offset. Regarding the two intermediate indexes, the FRB Updated index behaved much like the Federal Reserve Board index, while the FRB Updated and Expanded index behaved much like the FRBC index.

Comparison of the indexes in table 2 shows that the path of a dollar index can be strongly affected by the choice of currencies and weights, and by adjusting for inflation. However, the differences in path are not a criterion by which one index can be regarded as superior to another. There is no single "correct" index. An index should be constructed with its purpose in mind, and should be evaluated by how well it serves that purpose. We make such evaluations in part II.

II. The Model for Merchandise Trade

Our purpose for constructing a dollar index is to develop a tool that is helpful for explaining and predicting the effects of exchange-rate changes on U.S. merchandise trade. In this part, we use the FRBC index in developing a model of U.S. merchandise trade. The model employed in this study is a standard partial-equilibrium, four-equation representation of prices and quantities for U.S. merchandise exports and imports.[15] The model is designed to be a tool for short-run analysis and forecasting. With the model, the degree to which dollar appreciation or depreciation brings about changes in import and export prices, and the subsequent effect this has on the levels of real merchandise trade, can be estimated directly. Furthermore, the impact that economic growth in the United States relative to its major trading partners has on the balance of merchandise trade can also be evaluated.

The model works in two stages. In stage one, prices for exports and imports are derived from exogenous factors, including the exchange rate. In stage two, these predicted prices of exports and imports along with other exogenous determinants of demand generate the quantities of exports and imports. There is no feedback from stage two to stage one.[16]

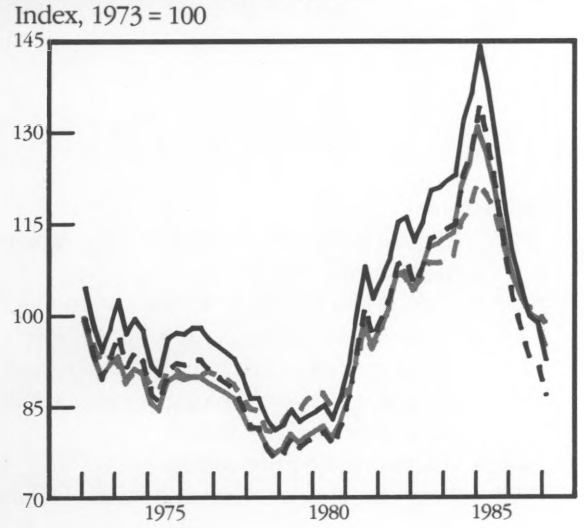
15 With a few exceptions, the approach taken to modeling merchandise trade in this study is quite similar to that taken in Feldman (1984), and to the aggregate version of the model in Rude (1986). While it is also generally similar to Hooper (1976), it is less ambitious in its specification. For additional approaches, see Deppler and Ripley (1978), Spitaller (1980), and Artus and McGuirk (1981).

16 Of course, an exchange rate is not completely exogenous and trade volumes probably affect prices, but a general equilibrium model is beyond the scope of this project.

The principal assumption underlying the model is that merchandise trade takes place in world markets that are characterized by imperfect competition. The products exported by any one country are differentiated from other foreign and domestic goods by differences in quality, contracts and agreements regarding delivery and servicing, and other factors that attract a buyer to a seller.[17] Producers are concerned about maintaining or increasing profit margins, or market shares, or both. Consumers strive to maximize utility subject to their income and to the relative prices of foreign and domestic goods.

Real Trade-Weighted Dollar Indexes

Index, 1973 = 100



——Board, 10 currencies, multilateral weights
– – –Board updated, 10 currencies, multilateral weights
——Board updated and expanded, 20 currencies, multilateral weights
– – –FRBC, 20 currencies, bilateral weights

SOURCE: Federal Reserve Bank of Cleveland.

FIGURE 5

This type of market environment has important implications for how exchange rates and economic growth affect the balance of trade. To begin, prices are not determined solely by world supply and demand conditions. Rather, since exporters in each country are imperfect competitors, they are able to exercise a certain amount of control in setting their prices. Given their concern for profit margins, one determinant of the price they establish is unit cost of production. Because they are also concerned with their market share, and face at least some degree of competition from foreign producers, they take the prices of competing foreign goods into consideration as well. Hence, pricing behavior is consistent with a conventional markup model where markets are oligopolistic.

Price Equations. Within this particular framework, U.S. merchandise export prices can be generalized as a function of the prices of competing foreign goods, the exchange rate, and production costs:

$$1) \quad PX = f(PF, ER, UC),$$

where *PX* is an index measure of prices for merchandise exports, *PF* is a price index of foreign goods that compete with U.S. exports expressed in units of foreign currencies, *ER* is a trade-weighted effective-exchange-rate index expressed as dollars per unit of foreign currency, and *UC* is an index measure of unit costs of production.[18] The price of exports is expected to be positively related to the dollar price of competing foreign goods and to unit costs.

The approach for U.S. merchandise import prices is much the same:

$$2) \quad PM = f(P, ER, UCF),$$

where *PM* is an index measure of prices for U.S. merchandise imports, *P* is an index measure of prices for U.S. goods that compete with foreign imports, and *UCF* is a measure of foreign unit costs of production. The price of imports is expected to be a positive function of the price of competing U.S. goods, the exchange rate, and foreign unit costs.[19]

The model provides a direct channel, then, by which changes in the exchange rate can affect the prices of U.S. exports and imports. The transmission of this impact is referred to as the "pass-through" effect. Pass-through is usually defined in terms of the price effect measured in terms of the importing country's home currency. In principle, the degree of pass-through depends

17 For instance, even if it were the same price or slightly more expensive than the other three, a consumer might still have strong reasons, stemming from tastes, product availability, and perceived quality differences, for buying a station wagon produced in Japan over a very similar one produced in Sweden, Germany, or the United States.

18 The exchange-rate index expressed as dollars per unit of foreign currency is simply the inverse of the exchange-rate index developed in part I of this study.

19 Previous studies have also included a measure of domestic and foreign demand pressures in their interpretations of how export and import prices are set. Typically, demand pressures are proxied by domestic and foreign capacity utilization rates. However, the results obtained in other empirical analyses from incorporating these additional determinants of pricing behavior have been mixed. Because of data limitations across the expanded set of countries used in our study, we omitted measures of demand pressure from the price equations altogether.

The Merchandise Trade Model[1]

1) *Implicit Price Deflator for Merchandise Exports*

$$PX_t = \underset{(-2.11)}{-0.91} + \underset{(4.80)}{0.36}\,(ERX \cdot FPX) + \underset{(7.98)}{0.51}\,DP_t + \underset{(5.42)}{0.63}\,e_{t-1}$$

R^2 (adjusted) = .9987 DW = 1.3
(t-statistics in parentheses) F-statistic = 8402.7
Sample period: 1975:Q1 - 1986:Q1

The coefficient for the exchange-rate term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3	t-4
0.06	0.09	0.10	0.08	0.03
(0.91)	(3.00)	(2.13)	(2.28)	(0.45)

Definitions:

PX = Implicit price deflator for U.S. merchandise exports.
ERX = Federal Reserve Bank of Cleveland merchandise export-weighted foreign-exchange-rate index. In estimating the model, the index is inverted so that it measures dollars per unit of foreign currency.
FPX = Merchandise export-weighted average foreign wholesale price index. The countries and weights are the same as in ERX.
DP = U.S. wholesale price index.
e = Identically and independently distributed random variable with mean of zero.

[1] Each equation was estimated on quarterly data using a maximum likelihood estimator with a correction for first-order autocorrelation. Lags were constrained to be second-order polynomials. All variables are in natural logs.

2) *Implicit Price Deflator for Nonpetroleum Merchandise Imports*

$$PM_t = \underset{(-3.27)}{-1.80} + \underset{(4.43)}{0.49}\,ERM + \underset{(3.01)}{0.59}\,DP_t + \underset{(1.83)}{0.33}\,FPM_t + \underset{(7.74)}{0.75}\,e_{t-1}$$

R^2 (adjusted) = .9986 DW = 1.3
(t-statistics in parentheses) F-statistic = 8103.6
Sample period: 1975:Q1-1986:Q1

The coefficient for the exchange-rate term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2
0.32	0.16	0.01
(5.13)	(4.43)	(0.17)

Definitions:

PM = Implicit price deflator for U.S. nonpetroleum merchandise imports.
ERM = Federal Reserve Bank of Cleveland nonpetroleum merchandise import-weighted foreign-exchange-rate index. In estimating the model, the index is inverted so that it measures dollars per unit of foreign currency.
DP = U.S. wholesale price index.
FPM = Nonpetroleum merchandise import-weighted average foreign wholesale price index. The countries and weights are the same as in ERM.
e = Identically and independently distributed random variable with mean of zero.

Source: Federal Reserve Bank of Cleveland.

BOX 1

on a variety of factors, including importantly U.S. and foreign exporters' trade-offs between desired profit margins and market shares.[20]

For example, consider the simplified scenario in which the dollar has depreciated against foreign currencies. For U.S. exporters, this means the dollar price of their goods has become less expensive relative to competing foreign goods, since one unit of foreign currency can now be exchanged for more dollars. At that point, U.S. firms can respond to the depreciation by adjusting the dollar price of their exports in one of three ways. If their sole objective is a higher profit margin, without regard to a greater market share, they could raise the dollar price of their goods by an amount sufficient to restore the pre-depreciation relative price of their product vis-a-vis competing foreign goods. Under these circumstances, no portion of the dollar's depreciation would be passed through into the foreign-currency prices of U.S. exports. At the other extreme, if their only objective is a greater market share without regard to raising profit margins, they would not raise the dollar prices of their

20 In the longer term, pass-through also depends on the effect that depreciation has on the cost of labor and other inputs, especially imported inputs. This is likely to be more important in nations where the ratio of trade volume to real GNP is high.

3) Real Merchandise Exports

$QX_t =$

$$\underset{(-3.56)}{-5.40} - \underset{(-4.43)}{1.18}\, PX/(ERX \cdot FPX) + \underset{(8.72)}{1.00}\, FGNPX_t + \underset{(7.07)}{0.73}\, e_{t-1}$$

R^2 (adjusted) = .9913 DW = 1.7
(t-statistics in parentheses) F-statistic = 1259.9
Sample period: 1975:Q1-1986:Q1

The coefficient for the relative price term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3	t-4	t-5	t-6
-0.02	-0.13	-0.20	-0.24	-0.24	-0.21	-0.14
(-0.12)	(-1.82)	(-2.47)	(-2.57)	(-3.12)	(-2.85)	(-0.88)

Definitions:

QX = U.S. merchandise exports, excluding automobile exports to Canada, on a balance-of-payments basis in 1982 dollars.
PX = Implicit price deflator for U.S. merchandise exports.
ERX = Federal Reserve Bank of Cleveland merchandise export-weighted foreign-exchange-rate index. In estimating the model, the index is inverted so that it measures dollars per unit of foreign currency.
FPX = Merchandise export-weighted average foreign wholesale price index. The countries and weights are the same as in ERX.
$FGNPX$ = Merchandise export-weighted foreign real gross national product. The variable FGNPX is the average of its contemporaneous and one-quarter-lagged values, where each period is assigned a weight of 0.5 in calculating the average. The countries and weights are the same as in ERX.
e = Identically and independently distributed random variable with mean of zero.

4) Real Nonpetroleum Merchandise Imports

$QM_t =$

$$\underset{(-6.31)}{-6.58} - \underset{(-5.77)}{1.74}\, (PM/DP) + \underset{(11.21)}{2.43}\, GNP_t + \underset{(6.77)}{0.71}\, e_{t-1}$$

R^2 (adjusted) = .9851 DW = 2.1
(t-statistics in parentheses) F-statistic = 729.71
Sample period: 1975:Q1 - 1986:Q1.

The coefficient for the relative price term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3	t-4	t-5	t-6
-0.33	-0.35	-0.35	-0.31	-0.24	-0.14	-0.01
(-1.52)	(-3.49)	(-3.36)	(-2.58)	(-2.40)	(-1.56)	(-0.56)

Definitions:

QM = U.S. nonpetroleum merchandise imports, excluding automobile imports to Canada, on a balance-of-payments basis in 1982 dollars.
PM = Implicit price deflator for U.S. nonpetroleum merchandise imports.
DP = U.S. wholesale price index.
GNP = U.S. real gross national product. The variable GNP is the average of its contemporaneous and one-quarter-lagged values, where each period is assigned a weight of 0.5 in calculating the average.
e = Identically and independently distributed random variable with mean of zero.

products at all, and the foreign-currency prices of their products would fall by the full amount of the depreciation. In this case, there would be complete pass-through. Finally, if U.S. exporters were interested in raising both their profit margins and their market shares, they would raise their dollar prices by less than the amount of the depreciation. Thus, the foreign-currency price of U.S. exports would still fall in response to the partial pass-through, but by an amount proportionately less than the depreciation. Changes in the exchange rate are passed through into U.S. import prices by foreign exporters in the same fashion and according to a similar set of considerations.

There are, of course, limits to the latitude with which U.S. and foreign exporters are willing and able to adjust their prices in response to changes in the exchange rate. Restated, there are constraints on the pass-through strategies that firms pursue vis-a-vis their profit-margin and market-share objectives. Some arise out of general macroeconomic uncertainties, having to do with the outlook for the economy or with monetary and fiscal policies.[21] Some constraints are contractual.

21 For a discussion of how these types of uncertainties might enter into firms' pricing decisions, see Mann (1986) pp. 368-369.

For example, if the dollar depreciates and U.S. exporters' prices were fixed in dollars by a contract, the degree of pass-through would by necessity be 100 percent. In contrast, if their prices were contractually fixed in units of a foreign currency, the degree of pass-through would be zero. Most studies of this topic, though, focus on constraints that are microeconomic in nature—market conditions having to do with the demand for and supply of a firm's product across international markets.

In practice, the degree of flexibility that U.S. firms have to raise the dollar price of their exports is generally greater the less price-elastic foreign demand for their good is and the less price-elastic supplies from other foreign or domestic competitors are. For the most part, foreign demand will be less elastic the more differentiated or specialized the exported good is, and the greater the world market share the U.S. exporter commands. The elasticity of supply for an exported good varies inversely with the level of capacity utilization in domestic and foreign industries producing the product, varies directly with the rate at which capacity for the production of the good can be increased at home and abroad, and varies directly with the supplies of the good held in inventories. Conversely, the more price-elastic demand for and total supplies of the exported good are, the greater will be the incentive for U.S. exporters to leave their dollar prices unchanged, thereby passing a higher portion of the depreciation through into lower foreign-currency prices. The degree of pass-through from foreign exporters into U.S. import prices is constrained by a similar set of factors.[22]

Volume Equations. The equations for quantities of merchandise exports and imports are demand functions expressed in terms of real income and relative prices. For merchandise exports, the general form is:

$$3) \quad QX = f[YF, PX/(PF \cdot ER)],$$

where QX is the quantity of U.S. merchandise exports, YF is an index of foreign real income, and the ratio $PX/(PF \cdot ER)$ measures the price of U.S. exports relative to the price of competing foreign goods. Exports are expected to respond positively to changes in foreign real income and negatively to changes in relative prices.

Similarly, for imports:

$$4) \quad QM = f(Y, PM/P),$$

where QM is the quantity of U.S. merchandise imports, Y is U.S. real income, and the ratio PM/P is the price of U.S. imports relative to competing domestic goods. Here again, quantities are expected to be positive functions of real income and negative functions of relative prices.[23]

The specification of the price and quantity equations has important implications for how changes in the nominal versus the real exchange rate affect merchandise trade. To be specific, since some portion of a change in the nominal exchange rate is passed through into export and import prices, it is also passed through into the relative price term in each quantity equation. There, it is deflated by a broader price index. Consequently, even though the exchange rate explicitly enters into the model in nominal terms, there is a real exchange-rate effect that implicitly enters into the equations for quantities.

Estimating the Model

In order to estimate the equations for merchandise export and import prices and quantities, a number of adjustments were made to the stylized version of the model. They were necessitated by the types of merchandise that the United States exports and imports, by data limitations, and by lags in some relationships.

One of the more important issues in modeling merchandise trade is deciding on which particular goods to include in the analysis. In this regard, it is worth recalling from our previous discussion that two basic premises embodied in the model are that traded goods are differentiated across sources of supply and that, by and large, exporters set prices according to a standard markup formula. While most manufactured goods may fit into this framework of analysis, certain basic commodities might not. Petroleum, for instance, is a fairly homogenous good regardless of who is exporting it. Moreover, since the early 1970s, the prices and quantities of petroleum and petroleum products worldwide have been influenced heavily by OPEC pricing strategies and output quotas. Finally, since petroleum is priced in dollars on world markets, its price is not directly sensitive to changes in the dollar exchange rate. For these reasons, petroleum and petroleum products are excluded from U.S. import prices and quantities in this study, as they are in most other empirical studies of merchandise trade.

22 See Spitaller (1980) and Feldman (Summer 1982) for a more complete discussion of microeconomic factors affecting the degree of pass-through.

23 Other studies have included additional determinants of demand in their specification of the quantity equations. These additional factors include proxies for demand pressures, dummy variables for dock strikes, and oil prices. Because the results obtained from incorporating these additional factors were mixed in other studies and because of data limitations across the expanded set of countries used in our study, we have excluded them.

Similar arguments can also be raised against including agricultural products: they are not easily differentiated across exporting nations; foreign suppliers frequently receive government subsidies to export their commodities; and, taking wheat as an example, agricultural products are often part of special purchasing deals between governments. Be that as it may, though, casual observation of developments in farm sectors in the United States and abroad indicate the occurrence of several important shifts in the 1970s and early 1980s. One is that the United States has become one of the world's high-price producers of many types of agricultural commodities. In addition, foreign production of agricultural goods has increased steadily. As a result, the United States now acts as the residual supplier to the rest of the world for a number of commodities. Moreover, U.S. imports of agricultural commodities have been on the rise since the early 1970's. All in all, these developments suggest that the U.S. balance of agricultural trade could well be sensitive to exchange-rate-induced changes in the relative prices of agricultural commodities in the United States and abroad, as well as to domestic and foreign income growth.

In this vein, Schuh (1984) has argued that changes in the value of the dollar were an important determinant of the U.S. agricultural trade balance in recent years. Furthermore, empirical work by Batten and Belongia (1984) has demonstrated that exports of U.S. agricultural goods are indeed driven by the same set of factors used to predict other types of merchandise exports—real income, relative prices, and the exchange rate. On balance, the reasons for including agricultural prices and quantities in the model seem to outweigh the reasons for excluding them, so they were incorporated into the analysis here.[24]

Finally, U.S. automobile trade with Canada is excluded from the merchandise export and import quantity equations. The reason is that these trade flows are largely the result of U.S. automakers' "exporting" parts to their Canadian factories for assembly, and then having the final products "imported" back. In this case, the volume of trade is more a function of the level of U.S. auto production than it is of the exchange rate, of relative prices, or of income levels in the United States and Canada.[25]

Aside from petroleum imports and automobile trade with Canada, though, the model is aggregative across merchandise export and import prices and quantities.[26] It is also aggregative across the same set of foreign trading partners used in constructing the effective trade-weighted dollar index in part I. As a result, the model cannot be used to address many of the interesting microeconomic issues associated either with U.S. trade relations with a particular country or with the consequences that exchange rates have for a particular industry. Nevertheless, by aggregating across countries and products, the model can be used to explore the causes of the overall trade deficit, as well as to evaluate some of the policy options for reducing the imbalance.

The model is structured so that export and import prices and quantities respond to their determinant factors both contemporaneously and with a lag. Previous empirical studies bear out this specification. In the price equations, U.S. and foreign exporters are assumed to react immediately to changes in their costs of production, but with a lag to changes in the exchange rate. One reason for the lagged response is that the dollar price of some exported goods may be fixed temporarily by individual contracts. Another reason is that exporters in the United States and abroad are less apt to risk a loss in their profit margins or market shares to changes in the exchange rate that they view as short-lived rather than permanent.

In the quantity equations, demand responds to the level of income in the current and previous period, but with a longer lag to changes in relative prices. Here again, U.S. and foreign importers are assumed to be more responsive to changes in the exchange rate that they perceive as permanent rather than temporary because of the transition costs associated with switching their sources of supply. Furthermore, there are likely to be lags between the time a product is ordered, because of a change in the exchange rate, and when it is delivered. Finally, U.S. and foreign consumers may simply be locked into a particular exporter for a certain period of time by a contract.

The lagged response of quantities to changes in relative prices can, in principle, give rise to what is commonly referred to as the "J-curve" effect. For example, following a depreciation in the value of the dollar, the path followed by the U.S. balance of trade over time could be one of an initial deterioration followed

24 The model in this study was estimated both with and without U.S. agricultural export prices and quantities. The equations fit the data about as well in each case, and the coefficient estimates were fairly similar.

25 See Rude (1986) for a discussion of the determinants of U.S.-Canadian auto trade. Although Mexico also borders the United States, U.S.-Mexican auto trade was not eliminated because it is relatively small and because we have no evidence that it is insensitive to exchange rates.

26 See Rude (1986) for an example of some of the insights to be gained from disaggregating a merchandise trade model by type of product. This extension, however, is beyond the scope of our study.

by an improvement—a path in the shape of a J. The initial deterioration could occur if the increase in U.S. import dollar prices caused a decline in import volume that initially was proportionally smaller than the price increase. Thus, imports in nominal terms would actually rise until quantities adjusted sufficiently to the change in prices. If this rise in the dollar value of imports were larger than the rise in the dollar value of nominal exports, the trade balance would deteriorate. When quantities adjusted more fully to the price changes, we would get the improvement in the trade balance one would ordinarily expect following a depreciation. The J-curve, of course, is relevant to the nominal merchandise trade balance, while this study focuses primarily on the real merchandise trade balance.

Turning to issues regarding data, the two endogenous price variables are represented by the implicit dollar price deflators for U.S. merchandise exports and nonpetroleum imports. Merchandise exports and nonpetroleum imports, each on a balance-of-payments basis excluding automotive trade with Canada, and measured in 1982 dollars, are the two dependent quantity variables. Several proxy variables were used for exogenous variables because of data limitations. The proxies selected are the same as, or similar to, those employed in other empirical studies of merchandise trade. In the export price equation, the U.S. wholesale price index is used to measure U.S. exporters' unit costs, and foreign wholesale price indexes are used to represent the prices of foreign goods competing with U.S. exports. The wholesale price indexes were used as proxies in the equation for import prices in an analogous manner. In the quantity equations, wholesale prices are intended to reflect the prices of goods competing with U.S. exports in foreign markets and with foreign imports in U.S. markets. Finally, U.S. and foreign real GNP served as proxies for real income.

It is worth noting that the foreign price, unit cost, and income exogenous variables, in addition to the exchange rate, are weighted-average indexes. All are constructed across the same set of countries as the exchange-rate index and use bilateral trade weights. For purposes of estimating the model, though, the weights in each index—including the exchange rate—are calculated according to a country's share of either the U.S. merchandise export or import measures employed here, as opposed to shares of total trade, depending on the equation in which they appear.

The model was estimated in log-linear form on quarterly data using a maximum likelihood estimator with a correction for first-order autocorrelation. Since it is specified in log-linear form, the estimated coefficients are elasticities. The sample period spans from 1975:Q1 through 1986:Q1 and, including the lags, does not go back further than 1973:Q2, when a fixed exchange-rate regime prevailed. By extending the sample period beyond the first quarter of 1985, the model is estimated over the latest period of dollar depreciation—a period that previous studies were unable to cover—as well as the preceding episode of appreciation. All lags are first-order or second-order polynomials with their far end unconstrained. Lag lengths were determined through specification search. The coefficient estimates each have the expected sign and, with the exception of several individual lagged coefficients, are statistically significant.[27] The regression results are reported in the box on page 12.

Discussion of Empirical Estimates

There are several important aspects of the empirical results. Starting with the price equations, the magnitudes of the long-run elasticities for the exchange-rate terms indicate that only a portion of changes in the exchange rate are ultimately passed through into export and import prices. For example, in response to a 10 percent depreciation in the dollar, U.S. firms could be expected to raise the dollar price of their exports cumulatively by 3.6 percent by the fourth quarter following the depreciation. That is equivalent to the foreign-currency price of U.S. exports falling by 6.4 percent (3.6 percent minus 10.0 percent). Similarly, foreign suppliers would be expected to raise the dollar price of U.S. imports by just under 5 percent. However, in this case, nearly all of the pass-through into import prices occurs during the current and first lagged periods, suggesting that the direct domestic price impulses from dollar depreciation end quite soon after the period of depreciation is over.

Compared to what studies elsewhere in the literature have found, the estimate of the coefficient for total exchange-rate pass-through into the foreign-currency price of U.S. exports, -0.64, is, on average, about 25 percent

27 With the exception of several individual lagged coefficients and the coefficient for foreign wholesale prices in equation 2, which is significant at the 95 percent level, all coefficients are significant at the 99 percent level.

larger in absolute value terms.[28] In contrast, the pass-through coefficient in the import price equation of 0.49 is about 25 percent lower, on average, than what has been estimated in the past.

One interpretation of the differences in the pass-through estimates rests with how U.S. and foreign suppliers may be adjusting their prices to the latest period of dollar depreciation. For U.S. suppliers, the argument would be that they have, to a greater extent than previously, foregone increases in their profit margins in order to increase their market shares abroad. In other words, the degree of pass-through into the foreign-currency prices of their exports is greater since the beginning of 1985 than it has been in the recent past.

Similarly, the reasoning in the case of foreign suppliers would be that in order to minimize their losses of market shares in the United States, they have been absorbing a higher-than-usual proportion of the dollar's depreciation—their home currency's appreciation—by reducing their profit margins. Of course, the relative degrees by which U.S. and foreign exporters are limiting their profit margins have important consequences for the extent to which the dollar's depreciation is likely to bring about an improvement in the real balance of merchandise trade over the near term.

Anecdotal evidence supports the profit-margin-cutting explanation. Between 1985:Q1 and 1986:Q2, for instance, the FRBC trade-weighted measure of the dollar fell by about 8.5 percent in nominal terms. At the same time, the implicit deflator for U.S. merchandise exports fell by more than 5 percent—implying that the foreign-currency prices of those goods fell even further—while the implicit deflator for nonpetroleum merchandise imports rose by only about 3.5 percent.

At a more analytic level, the empirical results in Mann (1986) indicate that foreign exporters to the United States are indeed cutting profit margins in the wake of the dollar's depreciation, and that U.S. exporters, while not necessarily cutting theirs, do not seem to be raising them either. Additional evidence comes from a simple re-estimation of the two price equations over a sample period ending in the first quarter of 1985—the apex of the dollar's appreciation. The coefficient of the exchange rate in the import price equation was higher by nearly 30 percent than in the longer sample period, thus eliminating the discrepancy with previous estimates, and supporting the view that foreign exporters are currently absorbing a larger-than-usual portion of the dollar's depreciation. In contrast, the coefficient of the exchange rate in the export price equation showed little change from the one estimated over the longer sample period, thus failing to help explain why our exchange-rate coefficient is smaller than that found in other studies.

The regression results also indicate that domestic cost pressures in the United States, and in foreign countries, play a role in influencing export and import prices. Firms in the United States apparently forward about half of the rate of change in U.S. wholesale prices into export prices. Foreign suppliers, though, transmit only about a third of the increases in their costs to U.S. import prices. Both coefficients—especially the elasticity of import prices to foreign costs—are of a lesser magnitude than what some previous studies have found.[29]

Here again, the differences in estimates may well be due to how U.S. and foreign suppliers have been responding to the dollar's depreciation since February 1985. The comparatively lower elasticity on production costs in both equations could indicate an increased desire on the part of both U.S. and foreign exporters to hold prices down in the face of rising costs, so as to expand market shares in the one case, and to maintain them in the other. Estimating the price equations over the shorter sample period supported this explanation. The coefficients on the domestic cost pressure terms in the export and import equations each rose to about 0.7.

The estimation results from the quantity equations bring to light several interesting conclusions. One is that the income elasticity of demand in the U.S. for imports (2.4) is considerably larger than it is in foreign countries for U.S. exports (1.0). All else constant, then, foreign real economic growth has to be substantially greater than the rate of real economic growth in the United States if the U.S. merchandise trade balance is to improve. Put differently, if real economic growth across our principal trading partners is

28 The magnitude of this coefficient does not seem to be due to the fact that our model is estimated across data from the 20 countries included in our trade-weighted exchange-rate index. When the export price equation was estimated for the 10 countries in the Federal Reserve Board's exchange rate index, using the weights from that index, the coefficient of exchange rate pass-through into the foreign-currency price of exports was found to be -0.75, which is even larger (absolutely) than ours.

29 In the export price equation (#1), we find the coefficient on the producer price index, which is used as a proxy for domestic unit cost of production, to be 0.51. If the proxy is a good one, and firms do not reduce profit margins to protect market share, the coefficient might be expected to be unity, which is what Stern, et al. (1979) found. While our result may raise some concerns, it is consistent with the findings of some other studies. See Feldman (1984) and Warner and Kreinin (1980).

Root-Mean-Square Errors of Predictions Made Using Four Alternative Exchange-Rate Indexes

	Index			
	FRBC	FRB	FRB Updated	FRB Updated and Expanded
Equation 1 (Export Deflator)	.034	.042	.041	.039
Equation 2 (Import Deflator)	.026	.037	.038	.026
Equation 3 (Export Volume)	.102	.086	.088	.122
Equation 4 (Import Volume)	.072	.075	.076	.064

Note: The model was estimated for each index, using variables reconstructed appropriately for that index. Each model's out-of-sample forecasting properties were evaluated by estimating the equations over a sample period from 1975:Q1 through 1983:Q4. The resulting estimated equations were then used to forecast the endogenous variables over the period from 1984:Q1 through 1986:Q1. The root-mean-square errors reported above were obtained by comparing the forecast values to the corresponding actual historical values.
Source: Federal Reserve Bank of Cleveland.

TABLE 3

equal to, or even exceeds somewhat, real growth in the United States, our merchandise imports would tend to continue to increase faster than our merchandise exports.

Most other recent models of merchandise trade also show a relatively higher income elasticity of demand for imports in the United States. The difference is not generally as pronounced as the coefficients in equations 3 and 4 suggest, mainly because the income elasticity of demand among foreign countries for U.S. exports has been found to be in the range from between 1.4 to 2.0.[30] One reason for this difference may lie with the particular countries that other studies include in their index measures of foreign real GNP. The manner in which those countries are weighted—either bilateral or multilateral—could also have a bearing.

To see if this explanation had merit, equation 3 was re-estimated across data from only the 10 countries—Japan, Canada, and eight European nations—typically included in more conventional measures of the dollar, using the corresponding multilateral rather than bilateral trade weights (see table 2). The result was that the income elasticity of demand for U.S. exports rose to 1.9. It seems, then, that the additional 10 countries in the FRBC index—which include the increasingly important trading partners in Asia—have a much lower income elasticity of demand for U.S. goods than do our long-standing trading partners, whose aggregate share of U.S. merchandise trade has been declining.

The income-elasticity estimates were almost the same when estimated for a shorter sample period. We re-estimated the model for a sample period of 1975:Q1 through 1983:Q4, and found the foreign-income elasticity of U.S. exports to be 1.10 and the U.S.-income elasticity of imports to be 2.35. This result suggests that our elasticity estimates were not the result of any unusual behavior in the 1983:Q4 through 1986:Q1 period.

Another salient feature of the quantity equations is the lags with which exports and imports respond to changes in relative prices. It takes a year (quarters t through t-3) before just half of the response of export quantities to a change in their price relative to competing goods is completed. In contrast, over three-fourths of imports' total response is completed in the first year. Furthermore, the total elasticity of import quantities to a change in relative prices is nearly half again as great as it is for export quantities.

At this point, it is worth recalling that the primary reason for constructing a new trade-weighted effective-exchange-rate index was to obtain a more accurate view of the dollar's impact on U.S. merchandise trade than might be obtained by using a more conventional index. In order to evaluate the forecasting performance of the FRBC exchange-rate index relative to a conventional index, the merchandise trade model that had been estimated with the FRBC index was re-estimated for the period 1975:Q1 through 1983:Q4. Then the model was also estimated for the same period using three versions of a well-established measure of the dollar and of the countries and trade weights corresponding to them. These were the same versions of the Federal Reserve Board index listed in table 2. Then, a series of out-of-sample forecasting tests was conducted with these four versions of the model over the nine-quarter period of dollar appreciation and depreciation beginning in 1984:Q1 and ending in 1986:Q1. The out-of-sample forecasting properties for these four versions of the model were then compared. The root-mean-square errors from the out-of-sample tests are reported in table 3 for each of the four equations (export deflator, import deflator, export volume, and import volume) for each of the four models. The

30 One problem in interpreting why the difference between the income elasticities of demand in the United States and in foreign countries was so much higher in our model is that other studies have tended to include proxies for demand pressures, in addition to real GNP, as explanatory variables in the quantity equations. In Feldman (1984), for example, not only was the U.S. income elasticity of demand for imports estimated to be 1.75, but the elasticity of U.S. imports with respect to the proxy for domestic demand pressure was also greater than one in absolute value as well as statistically significant.

T-Statistics for Tests Comparing Predictions Made Using Four Alternative Exchange-Rate Indexes

	FRBC Compared to		
	FRB	FRB Updated	FRB Updated and Expanded
Equation 1 (Export Deflator)	-8.78**	-10.18**	-8.13**
Equation 2 (Import Deflator)	-7.23**	-7.94**	-2.48*
Equation 3 (Export Volume)	1.60	2.19	-1.39
Equation 4 (Import Volume)	-5.79**	-6.24**	-0.25

Note: Negative t-statistics indicate the FRBC predictions were superior; positive t-statistics indicate they were inferior. There were seven degrees of freedom. Double asterisk (**) indicates significance at the 99.9 percent confidence level. Single asterisk (*) indicates significance at the 95 percent confidence level. The tests compared the variances of the one-quarter-ahead forecast errors for the out-of-sample forecasts described in table 3.
Source: Federal Reserve Bank of Cleveland.

TABLE 4

FRBC index yields smaller errors for three of the four equations compared to the Federal Reserve Board index and compared to the FRB Updated index. The FRBC index yields smaller errors in two and an identical error in one of the four equations compared to the FRB Updated and Expanded index. Thus, the FRBC index, in this test, appears to be better than two of the other indexes, and at least as good as the third index.

To determine whether the differences in the out-of-sample forecast errors were statistically significant, we performed tests comparing the variances of the one-quarter-ahead forecast errors.[31] These tests compared the forecast errors of the FRBC index equations with those of (1) the Federal Reserve Board index equations, (2) the FRB Updated index equations, and (3) the FRB Updated and Expanded index equations. The test results reported in table 4 support the conclusions suggested by the root-mean-square-error comparisons described above. The performance of the FRBC index equations was superior for 10 of the 12 tests. Eight of the 10 were statistically significant at high levels of confidence. For the two cases in which the FRBC equations appeared not to be superior, the test results were not statistically significant. Thus, the FRBC index, in this test, appears to be better than the other three indexes.

Of course, there are no doubt conditions under which a model estimated using the Federal Reserve Board exchange-rate index would do a better job of predicting merchandise trade flows than the FRBC version. Examples of such conditions might be a different out-of-sample test period, or the use of a different merchandise trade model altogether. Nevertheless, for a recent nine-quarter period of dollar appreciation and depreciation, and using a standard, well-established trade model, the FRBC trade-weighted effective exchange-rate index appears to be a better overall predictor of U.S. merchandise trade.

Intuitively, it would appear that the slower rate of dollar depreciation since 1985:Q1, as measured by the FRBC index, means that the potential near-term improvement in the trade balance—and the ensuing boost to real economic growth—will be less than what more-conventional indexes might predict. In addition, the inflationary risks associated with dollar depreciation to date are probably behind us and seem to have been mitigated by profit-cutting actions on the part of foreign exporters to the United States. This issue is pursued in the next section.

Estimating the Effects of Different Effective-Exchange-Rate Indexes on U.S. Merchandise Trade

To provide a basis for comparing how different approaches to measuring changes in the dollar's average exchange rate can affect estimates of the U.S. merchandise trade balance, we tested to find the effect on U.S. merchandise trade from the depreciation of the dollar that occurred between 1985:Q1 and 1986:Q4. We then repeated that test using a trade model estimated using the Federal Reserve Board index. That model is presented in the appendix. The techniques used in these tests and the results obtained are reported in tables 5 and 6.[32]

When using the estimates of effects on trade from dollar depreciation, the reader should keep in mind that this model, like any

31 The test is described by Meese and Rogoff (1985), p. 21.

32 In both simulations, only the direct effects of changes in the exchange rate on export and import prices and quantities were estimated. Further exchange-rate effects, such as those on the exogenous prices of competing domestic and foreign goods, on unit costs of production, and on income are not considered. These additional effects, though, do have some bearing on the response of merchandise trade to changes in the exchange rate. Feldman (1984), for example, attempts to incorporate the impact on home prices into his analysis by adjusting his results according to the elasticity of domestic goods' prices with respect to changes in the exchange rate as calculated elsewhere in the literature. Ideally, though, elasticities such as these would be obtained from relationships estimated across the same group of countries and the same measures of the exchange rate, prices, and real income as those employed in the particular trade model being estimated. Unfortunately, this extension is beyond the scope of our paper.

Table 5 Effects of Dollar Depreciation from 1985:Q1 to 1986:Q4, as Measured by the FRBC Exchange Rate Index, on U.S. Real Merchandise Trade[1]

	Cumulative Percent Change From 1985:Q1 Through:			Cumulative Change in Billions of 1982 Dollars From 1985:Q1 Through:	
Change in[2]	1986:Q4	1987:Q4	Change in[2]	1986:Q4	1987:Q4
Real Exports	4.6%	6.8%	Real Exports	$10.4	$15.4
Real Imports	-7.3%	-10.2%	Real Imports	-$20.5	-$28.7
Addendum: Import Deflator	6.0%	6.0%	Real Balance of Trade	$30.9	$44.1

1. The effects of the dollar's depreciation were estimated as follows. First, the merchandise trade model was simulated from 1985:Q1 through 1987:Q4, holding all exogenous variables constant at their 1985:Q1 levels. Then the model was simulated through 1987:Q4, allowing the exchange rate index to follow its historical path from 1985:Q1 to 1986:Q4, remaining constant thereafter, while holding all other exogenous variables constant at their 1985:Q1 levels. The difference between the two sets of simulated paths for the endogenous variables is the estimated effect of the dollar's historical depreciation on export and import price and quantity variables from 1985:Q1 through 1987:Q4.
2. Real exports are U.S. merchandise exports on a balance-of-payments basis, excluding automobile exports to Canada, in 1982 dollars. Real imports are U.S. nonpetroleum merchandise imports on a balance-of-payments basis, excluding automobile imports from Canada, in 1982 dollars. The import deflator is the implicit-price deflator for U.S. nonpetroleum merchandise imports.
Source: Federal Reserve Bank of Cleveland.

Table 6 Effects of Dollar Depreciation from 1985:Q1 to 1986:Q4, as Measured by the Federal Reserve Board Exchange Rate Index, on U.S. Real Merchandise Trade[1]

	Cumulative Percent Change From 1985:Q1 Through:			Cumulative Change in Billions of 1982 Dollars From 1985:Q1 Through:	
Change in[2]	1986:Q4	1987:Q4	Change in[2]	1986:Q4	1987:Q4
Real Exports	12.4%	29.1%	Real Exports	$28.3	$65.8
Real Imports	-14.8%	-19.8%	Real Imports	-$41.7	-$55.7
Addendum: Import Deflator	12.3%	12.5%	Real Balance of Trade	$70.0	$121.5

1. The effects of dollar depreciation as measured by the Federal Reserve Board index were estimated as follows. First, the merchandise trade model in the box was reestimated using the countries, currencies, and weights that correspond to the Federal Reserve Board index. Then this new model was simulated from 1985:Q1 through 1987:Q4 holding all exogenous variables constant at their 1985:Q1 levels. Then the model was simulated through 1987:Q4 allowing the Federal Reserve Board exchange rate index to follow its historical path from 1985:Q1 to 1986:Q4, remaining constant thereafter, while holding all other exogenous variables constant at their 1985:Q1 levels. The difference between the two sets of simulated paths for the endogenous variables is the estimated effect of the dollar's historical depreciation, as measured by the Federal Reserve Board index, on export and import price and quantity variables from 1985:Q1 through 1987:Q4.
2. Real exports are U.S. merchandise exports on a balance-of-payments basis, excluding automobile exports to Canada, in 1982 dollars. Real imports are U.S. nonpetroleum merchandise imports on a balance-of-payments basis, excluding automobile imports from Canada, in 1982 dollars. The import deflator is the implicit-price deflator for U.S. nonpetroleum merchandise imports.
Source: Federal Reserve Bank of Cleveland.

partial-equilibrium model, fails to capture feedback and other effects, some of which might be quite important. However, construction of a general equilibrium model is beyond the scope of this study, which has as its main purpose to determine if an index of the dollar that is broader than the conventional indexes is more useful for predicting trade prices and volume.

The simulation with our model indicates that dollar depreciation from 1985:Q1 through 1986:Q4 should, all other trade influences unchanged, yield a $44 billion improvement in the real-merchandise trade balance by the end of 1987. Of this, $31 billion should have occurred by the end of 1986, leaving only a $13 billion improvement to be expected in 1987 (table 5). Of course, all other influences on trade were not unchanged and there was not, nor should we have expected, a net improvement of $31 billion prior to the end of 1986. For example, lagged effects of previous dollar appreciation, income growth, and endogenous price changes also were affecting the trade balance.

To determine how much of this simulation result was caused by use of our broader, newer index, we performed the same test using the same model and a narrower, older, established index. We re-estimated the model using the 10 countries, currencies, and weights that correspond to the Federal Reserve Board index. Then we performed the same simulation, which indicated that dollar depreciation through the end of 1986 should, ceteris paribus, yield a $122 billion improvement in real-merchandise trade by the end of 1987, with $52 billion of it to occur in 1987 (table 6). Thus, the difference in indexes causes a fourfold difference in the predicted impact in 1987. This difference can be attributed to the differences in weights and countries employed in the two indexes and to the differences in coefficients estimated in the models.

III. Conclusions

Our research suggests four conclusions about exchange-rate indexes for the dollar. First, several nations whose currencies are excluded from the traditional exchange-rate indexes for the dollar have been increasing in importance as U.S. trade partners. Second, the FRBC index, which includes the currencies of some of these other nations and has more up-to-date weights, indicates that a much smaller proportion of the dollar's 1980:Q3-1985:Q1 appreciation had been reversed by 1986:Q4 than is indicated by a traditional index. Third, out-of-sample tests suggest that the trade model estimated in this paper using the FRBC index is probably better than the same model estimated using a traditional index. Thus, the FRBC index developed in this paper appears to be a useful tool for helping to explain and predict U.S. trade flows. Finally, the method of index construction has a significant impact on estimates of the effect of dollar depreciation on the balance of trade.

Appendix
The FRBC Merchandise Trade Model Re-estimated Using the Federal Reserve Board's Trade-Weighted Effective Exchange-Rate Index

1) *Implicit Price Deflator for Merchandise Exports*

$$PX_t = \underset{(-1.18)}{-0.35} + \underset{(5.28)}{0.25}\,(ERX \cdot FPX) + \underset{(15.69)}{0.61}\,DP_t + \underset{(4.77)}{0.58}\,e_{t-1}$$

R^2 (adjusted) = .9986 DW = 1.3
(t-statistics in parentheses) F-statistic = 7609.9
Sample period: 1975:Q1 - 1986:Q1

The coefficient for the exchange-rate term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3	t-4	t-5
0.01	0.03	0.05	0.05	0.05	0.04
(0.38)	(2.35)	(1.91)	(2.25)	(3.43)	(1.02)

2) *Implicit Price Deflator for Nonpetroleum Merchandise Imports*

$$PM_t = \underset{(-1.28)}{-0.66} + \underset{(4.01)}{0.31}\,ERM + \underset{(3.45)}{0.75}\,DP_t + \underset{(0.47)}{0.11}\,FPM_t + \underset{(8.91)}{0.80}\,e_{t-1}$$

R^2 (adjusted) = .9986 DW = 1.1
(t-statistics in parentheses) F-statistic = 7582.0
Sample period: 1975:Q1 - 1986:Q1.

The coefficient for the exchange-rate term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2
0.20	0.11	0.01
(5.05)	(4.01)	(0.07)

3) *Real Merchandise Exports*

$$QT_t = \underset{(-8.32)}{-7.98} - \underset{(-7.61)}{0.79}\,PX/(ERX \cdot FPX) + \underset{(14.24)}{1.94}\,FGNPX_t + \underset{(3.85)}{0.52}\,e_{t-1}$$

R^2 (adjusted) = .9920 DW = 1.7
(t-statistics in parentheses) F-statistic = 1243.7
Sample period: 1976:Q1 - 1986:Q1

The coefficient for the relative price term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3
0.01	-0.05	-0.10	-0.13
(0.37)	(-1.78)	(-3.70)	(-3.57)

t-4	t-5	t-6	t-7	t-8
-0.15	-0.14	-0.12	-0.09	-0.03
(-3.79)	(-4.70)	(-6.09)	(-2.24)	(-0.42)

4) *Real Nonpetroleum Merchandise Imports*

$$QM_t = \underset{(-6.31)}{-6.58} - \underset{(-5.77)}{1.74}\,(PM/DP) + \underset{(11.21)}{2.43}\,GNP_t + \underset{(6.77)}{0.71}\,e_{t-1}$$

R^2 (adjusted) = .9851 DW = 2.1
(t-statistics in parentheses) F-statistic = 729.71
Sample period: 1976:Q1 - 1986:Q1.

The coefficient for the relative price term is a long-run elasticity and is the sum of the following contemporaneous and lagged coefficients:

t	t-1	t-2	t-3	t-4	t-5	t-6
-0.33	-0.35	-0.35	-0.31	-0.24	-0.14	-0.01
(-1.52)	(-3.49)	(-3.36)	(-2.58)	(-2.40)	(-1.56)	(-0.56)

Appendix (continued)

The merchandise-trade model developed in part II is estimated here using the Federal Reserve Board trade-weighted effective exchange-rate index. In this case, all exogenous variables in the model were reconstructed on the basis of the actual multilateral weights and the 10 countries used in the Federal Reserve Board's index (see table 2). The definitions of all variables are the same as those listed in the box. Lag lengths were determined by specification search and, hence, were allowed to differ from the FRBC version of the model. Three out of the four equations were estimated over a sample period from 1975:Q1 to 1986:Q1, the same as for the FRBC model. In the other equation, because the lags were longer, the sample period began in 1976:Q1 in order to exclude observations from the period during which exchange rates were fixed. The estimation technique was the same as for the FRBC version, and all variables are in natural logs.

By and large, the estimation results indicate that the version of the model estimated using the Federal Reserve Board dollar index fits the data well. The coefficients are each of the expected sign and, with the exception of the elasticity of import prices with respect to foreign wholesale prices and a few individual lagged coefficients, each is statistically significant.

In the equation for real nonpetroleum merchandise imports, since the exchange-rate term and measures of foreign prices and income do not explicitly appear as determinant factors, the coefficient estimates above are identical to those estimated in the FRBC version of the model.

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How Will Tax Reform Affect Commercial Banks?

by Thomas M. Buynak

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Introduction

Last year, Congress enacted the Tax Reform Act of 1986, which fundamentally restructures and simplifies the federal income tax system. Beginning in 1987, individuals and corporations face much simpler federal income tax rules that contain lower marginal tax rates.

There is widespread speculation about the effects of such sweeping federal income tax reform. Economists, policymakers, and politicians are debating the extent to which the new tax rules could adversely affect specific economic sectors or groups, particularly capital-intensive industries, certain income classes of individual taxpayers, real estate, and the banking industry.

In the commercial banking industry, the new tax rules will affect banks at a time when the commercial banking system is undergoing profound structural changes that are eroding the industry's ability to consistently generate healthy profits on traditional banking products and services. During the balance of the 1980s and into the 1990s, commercial banks will face several critical issues, including risk-based capital standards, deregulation, broader geographic competition, and possibly increasing competition from nonbank companies like Sears, Roebuck and Company, and Merrill Lynch & Co., Inc.

This article examines how tax reform could potentially affect the future tax liability of commercial banks. The analysis concentrates on Ohio banks and estimates the 1985 taxes they paid under the old corporate federal income tax rules. This benchmark estimate is then compared to a similar estimate made using the new tax rules.

The analysis calculates the tax burden for both small-to-medium and large Ohio banks so that we can detect disproportional effects of the new tax rules, if any, on different-size Ohio banks. It is presumed that large banks ($500 million or more in assets) should be affected more adversely than small-to-medium banks (with assets less than $500 million) because the new corporate tax code eliminates more existing tax preferences for large banks.

I. Old Versus New Corporate Federal Income Tax Rules

Under the new federal corporate income tax regime, commercial banks will lose a substantial amount of their tax preferences, or deductions, that they relied upon to reduce their taxable income. In return, they will face much lower marginal tax rates.

It is the intention of Congress that the new tax code's lower corporate tax rates should not entirely offset the loss of commercial bank tax preferences. Consequently, the typical bank should pay a higher tax bill in 1987. Congress revised the federal income tax code so that approximately $150 billion of federal taxes during the next five years will shift from individuals to corporations. According to Congressional estimates, the commercial banking industry, one of

Do Commercial Banks Pay Lower Federal Income Taxes Than Their Nonfinancial Counterparts?

There has been much controversy about whether or not banks have paid a tax liability that is considerably less than that paid by nonfinancial corporations. According to estimates by the Bureau of Economic Analysis of the U.S. Department of Commerce, corporations paid an effective average federal income tax rate in the 23- to 25-percent range from 1980 to 1983.

Studies that estimate the *direct* tax liability of commercial banks find that the banking industry has indeed paid a relatively lower federal tax liability. One recent study estimates the tax liabilities of all profitable banks nationwide during 1985.[1] This nationwide estimate finds that all banks together paid an average 1985 direct-tax rate of approximately 11 percent. An even lower average rate has been estimated by the Joint Committee on Taxation (JCT) for the tax liability of the nation's *largest* banks.[2] The JCT finds that large banks, which presumably are better managers of their tax liability, have either paid no taxes or have paid an extremely low tax rate (less than 5 percent) as a percentage of their net income in recent years. The JCT cautions, however, that this low-tax-rate estimate may understate these banks' true economic tax burden because it fails to include *indirect* taxes paid by them.

Surveys by the Bank Administration Institute (BAI), a bank-sponsored research and educational organization, attempt to adjust for indirect bank taxes.[3] BAI incorporates two types of indirect bank taxes: one is for the opportunity cost of holding non-interest-bearing accounts with the Federal Reserve for monetary policy purposes, and the other adjusts for foregone earnings on lower-yielding tax-exempt municipal obligations. According to BAI's surveys, banks nationwide paid effective tax rates, which include direct and indirect taxes, of between 43 and 52 percent from 1982 through 1984.

The available evidence indicates that banks generally have paid a low rate of direct taxes. However, if we account for indirect bank taxes, it is evident that the economic tax liability of banks at least begins to approach the average tax liability of nonfinancial corporations.[4]

1. See Gelfand, Matthew D., and Gerald A. Hanweck, "The Effects of Tax Reform on Banks," *The Bankers Magazine*, Jan.-Feb 1986, pp. 59-66.

2. See Taxation of Banks and Thrift Institutions, Joint Committee on Taxation, March 9, 1983.

3. See Survey of U.S. Effective Income Tax Rates for the Banking Industry, Bank Administration Institute, 1982-84.

4. See Henderson, Yolanda K. "The Taxation of Banks: Particular Privileges or Objectionable Burdens?" *New England Economic Review*, Federal Reserve Bank of Boston, May/June 1987, pp. 3-18.

BOX 1

the industries Congress has singled out as low taxpayers, will pay approximately $10 billion of the higher corporate tax liability during the next five years (see box 1). According to estimates by the industry itself, commercial banks could pay as much as $20 billion more in federal taxes during the next five years.

Under the old corporate tax rules, a commercial bank could reduce its federal taxable income by claiming several deductions, including interest expenses on the holding of tax-exempt securities, a bad-debt reserve provision, accelerated depreciation, and investment and foreign tax credits (see table 1). The new tax code either repeals these tax preferences or substantially reduces the tax-deductible allowable amounts. The new code also imposes a much more stringent and complicated minimum corporate tax to ensure that no profitable corporation will avoid paying federal income taxes beginning in 1987.

The former top corporate tax rate of 46 percent falls to 34 percent under the new rules. The revised rules also substitute two lower marginal rates on income up to $75,000 for the four previous lower marginal rates on income up to $100,000. A corporate tax rate of 15 percent will now apply to taxable income up to $50,000; a 25 percent rate will apply on income from $50,000 to $75,000. Under the new tax rules, corporations also will pay an additional 5 percent tax, up to a maximum of $11,750, on corporate taxable income from $100,000 to $335,000. A corporation with taxable income greater than $335,000 will pay a flat rate of 34 percent.

Under the new rules, the future tax liability of large banks will be affected more severely than that of small and medium banks because tax reform repeals more deductions for large banks. In particular, large banks not only lose the ability to use the reserve method of tax deduction for bad debt, but also must add their accumulated bad-debt reserves into taxable income during the next four years.

II. Taxes Paid by Ohio Banks Under Old Federal Income Tax Rules

In our study, we estimate the average tax rate of 291 Ohio banks that posted a 1985 profit. Seventeen Ohio banks reporting a loss in 1985 were excluded (there seems to be no systematic reason to explain why the excluded banks reported a loss). The profitable Ohio banks are divided into two groups: one includes 264 small and medium banks; the other includes 27 large banks. We first calculate the *average direct tax rate* for the sampled Ohio banks. This estimated average rate then serves as a benchmark against which we quantitatively simulate how the new tax rules would have affected the 1985 tax liability of these banks.

New Federal Income Tax Rules Affecting Commercial Banks

Title	Old Tax Provision	New Tax Provision
Effective Date		General Effective Date: Jan. 1, 1987 Corporate Rate Cuts: July 1, 1987
Corporate Tax Rate	46% top rate, 4 lower rates on income up to $100,000	34% top rate, 2 lower rates on income up to $75,000
Corporate Minimum Tax	15% of the amount of which the sum of tax preference items exceeds the greater of $10,000 or the regular tax liability	20% alternative minimum tax; $40,000 income exemption
Bad-Debt Reserve	Deductible	Eliminates bad-debt tax reserve for banks with more than $500 million in assets
Tax-Exempt Securities	80% of municipal bond interest expense is exempt from federal taxation	100% of municipal bond interest expense is taxed
Net Operating Loss Carryover	Losses carried back 10 years and forward 5 years	Losses carried back only 3 years, but forward 15 years
401(K)s and IRAs	401(K): $30,000 maximum IRAs: $2,000/$250 for nonworking spouse	401(K): $7,000 maximum IRAs: Limits imposed on high-income workers with pensions
Foreign Tax Credit	Credit determined on aggregated foreign income	Less liberal foreign tax credits, with transition provisions
Depreciation	Accelerated	Less generous write-offs, particularly for real estate
Investment Tax Credit	6% to 10%	Repealed

Source: Ernst & Whinney. Tax Reform—1986, An Analysis of Provisions Relating to the Financial Services Industry, E&W No. X58055; and Tax Reform—1986, An Analysis of the Internal Revenue Code of 1986, E&W No. 66196.

TABLE 1

Because Internal Revenue Service (IRS) tax returns are confidential, we manipulated financial information reported by the sampled Ohio banks in 1985 so that we could, in effect, simulate their 1985 IRS returns. To do this, it was necessary to impose several simplifying assumptions that possibly cause the estimates to deviate from the banks' actual IRS tax returns. Despite this unavoidable shortcoming, the simulated results allow us to make reasonable inferences about the direction and the degree to which each of the tax changes potentially could affect the *typical* small-to-medium or large Ohio bank.

As a final word of caution, we assume that banks, borrowers, other lenders, depositors, and other economic actors behave no differently under the new tax rules than they did in 1986. The banking business, of course, is not likely to remain static. Banks undoubtedly will restructure their balance sheets in order to lessen their burdens in the new tax environment. Banks' balance sheets also will be influenced by induced tax-law changes in loan demand, by changes in investment yields, and by depositors' behavior.

The simulation estimates do not capture these unknown influences, or even the unknown degree of probable effects on banks' balance sheets in the future. Consequently, the simulated effects of the new tax code on Ohio banks are most likely a "worst-case" estimate of additional taxes they will pay.

The probable adverse effects of the new tax rules on banks' tax liability also will be

Estimated 1985 Tax Liability of Ohio Banking Organizations Under the New Federal Income Tax Code
(dollars in millions)

	Under Old Tax Rules		Under New Tax Rules	
	Small & Medium Banks[a]	Large Banks[b]	Small & Medium Banks[a]	Large Banks[b]
1. Pre-Tax Income	$284.8	$730.5	$284.8	$730.5
2. Taxable Income	$103.9	$314.4	$114.0	$437.1
3. Regular Tax Liability	$43.2	$144.1	$ 35.9	$148.3
4. Tax Credits	$5.5	$19.2	—	—
5. Add-On or Minimum Taxes	$ 0.4	$ 0.5	$ 9.4	$ 7.3
6. Net Tax Liability	$ 38.1	$125.4	$45.3	$155.6
7. Average Tax Rate (ATR)	13.3%	17.1%	15.9%	21.3%
ATR of All Ohio Banks	16.1%		19.8%	

a. Ohio banks with assets less than $500 million.
b. Ohio banks with assets greater than $500 million.

Source: Consolidated Report of Condition and Income, December 31, 1985.

TABLE 2

mitigated because banks, to a large degree, merely serve as a conduit through which they intermediate tax benefits to their customers by extending them more favorable rates or terms on loans and leases—assuming that a competitive marketplace for these banking products exists. As we will discuss shortly, the consequence of eliminating certain tax advantages will put upward pressure (that is, for less-favorable terms) on loan and lease rates, yielding higher average revenues that will offset the elimination of banks' tax preferences. However, higher lease rates could lead to lower sales volume.

The new tax rules, moreover, phase out the deductibility of interest on consumer debt over a four-year period, except for consumer debt that is secured by a home mortgage. A likely result of this action may be a widespread restructuring of consumer debt. Under the new tax rules, many homeowners have an incentive to rely on home-equity credit lines, rather than on traditional consumer credit like auto loans, as the tax-advantaged method to finance their purchases. Many commercial banks will have a comparative advantage as suppliers of home-equity credit lines because they typically have experience in both mortgage financing and open-end credit lending.

In 1985, the 291 profitable Ohio banks reported net income of approximately $1.02 billion. Because banks do not report taxable income, it was necessary to estimate taxable income from the banks' year-end 1985 Reports of Condition and Income. A reasonable estimate of taxable income can be derived if we subtract the major tax deductions that banks can use to reduce their taxable income. Most of the difference between taxable and net income is attributed to tax-exempt income on municipal obligations; to foreign, state, and local income and excise taxes; and to lower-taxed capital gains—which are subject to a 28 percent tax rate. Banks also are permitted to deduct a tax reserve for loan losses that differs from their book bad-debt reserve. A reasonable estimate of the 1985 tax bad-debt reserve is approximately 55 percent of the 1985 book bad-debt reserve.[1]

By reducing banks' net income by these tax deductions and after adjusting net income for differences between book and tax bad-debt reserves, we should get an unbiased estimate of Ohio banks' 1985 taxable income.

We estimate that Ohio banks had 1985 federal taxable income of approximately $418 million (see table 2). Ohio banks paid an estimated regular tax liability of approximately $187 million in 1985, which was partially offset by tax credits of almost $25 million. Banks also paid an estimated add-on tax of approximately $1 million. The combined net federal tax liability of the Ohio banks—that is, regular taxes, plus add-on taxes, minus tax credits—amounted to almost $164 million in 1985, which is an average tax rate of 16.1 percent.

The average tax rate paid by small- and medium-size Ohio banks (13.3 percent) under the old tax rules was lower than that of the large Ohio banks (17.1 percent). One reason that small- and medium-size Ohio banks paid a lower average tax rate is because they reported a relatively lower level of estimated taxable income. The lower taxable income of small- and medium-size Ohio banks is attributed mostly to the fact that they hold a higher percentage of their assets (as compared to large banks) in the form of municipal obligations. Another reason is that there was little difference between the effect that tax credits had on mitigating the tax liability of either large, medium, or small Ohio banks. In other words, small- and medium-size Ohio banks relied on tax credits to the same approximate relative degree that large banks relied on tax credits to reduce their federal income tax liability.

1 Our estimate of the tax reserve deduction is based on the results of a U.S. Treasury bank tax model. See Neubig, Thomas S. and Martin A. Sullivan, "The Effect of the Repeal of the Reserve Method on Loan-Loss Reserves and Loan Charge-Offs," 1987 Tax Analysts, Tax Notes, April 27, 1987, Special Report, pp. 401-403.

III. Principal Tax Provisions Affecting Commercial Banks

Tax-Exempt Securities. Under the old tax rules, commercial banks could deduct 80 percent of interest expenses that were incurred to carry tax-exempt securities in their asset portfolios. As a consequence, there was a strong incentive for commercial banks to hold municipal securities to reduce their federal tax burden.

The new tax rules disallow 100 percent of the interest charge for carrying municipal obligations *acquired* after August 7, 1986. There is one exception: under the new tax rules, a municipality still will be permitted to sell up to $10 million of bonds to a financial institution per year, and the financial institution can apply the old interest expense disallowance rule (20 percent) to the bonds.

Commercial banks are an integral part of the municipal bond market, and currently hold approximately one-third of outstanding municipal obligations. Unless tax-exempt yields rise substantially closer to yields on taxable securities to compensate for the less-favorable tax status of municipals, banks will accumulate smaller future holdings of tax-exempt securities under the new tax rules. In all likelihood, the tax-law changes will hasten banks' exit from the tax-exempt municipal securities market, accelerating a trend that began in the mid-1970s.

One alternative to holding municipal obligations as a tax-sheltering device has been leasing receivables. Since 1981, large banks in particular have substituted leasing to varying degrees for tax-exempt securities as a more effective way in which to shelter income. Under the old tax rules, banks were allowed a high degree of leveraging of investments in physical assets because of liberal depreciation schedules and investment tax credits (ITCs). Faster depreciation write-offs and ITCs magnify the net after-tax yields for asset leasing. In fact, the tax advantages of leasing have made it a profitable substitute for direct lending by banks.

Small banks engage in virtually no leasing activity because they do not have the large and diverse portfolios to absorb the greater risk and lower liquidity associated with leasing receivables. A small bank, moreover, is less able to price its leasing products competitively because leasing normally requires a large volume to economically justify the expense of a specialized leasing staff.

Repealing the deduction for municipal-securities-interest expense will, other things being equal, raise taxable income for the typical commercial bank, unless other tax-shelter adjustments are made to offset elimination of the deduction. The relatively large amount of municipal bonds held by small and medium banks is their primary means for sheltering taxable income. It is likely that these banks have a higher percentage of municipal holdings because they primarily service local governments, whose debt is frequently purchased and held mostly by local financial institutions. In contrast, larger banks are located in large cities whose municipal debt is traded publicly.

On the surface, it appears that large banks might be relatively less affected than small and medium banks by the loss of the municipal-interest-expense deduction because large banks have more tax-sheltering alternatives available to them. For example, large banks could in part substitute leasing activity for municipals as a way to shelter taxable income. But leasing becomes less attractive as a shelter under the new tax code because the code repeals ITCs and revises depreciation schedules for physical assets.

In table 3, we report the simulation results of how each tax provision potentially

Simulated Effects of New Federal Income Tax Rules on Ohio Banking Organizations

Tax Provision	Percentage Change in 1985 Tax Liability		
	All Banks	Small & Medium Banks[a]	Large Banks[b]
Repeal Interest Expense Deduction for Tax-Exempt Municipal Bonds[c]	4%	5%	4%
Repeal Bad-Debt Deduction	7%	5%[d]	8%
Tax Bad-Debt Accumulated Reserve			
(10% of reserve)	12%	11%[d]	12%
(40% of reserve)	48%	44%	49%
Repeal Investment Tax Credit	13%	14%	13%
Replace Foreign Tax Credit as a Deductible Expense	0.8%	0%	1%
Alternative Minimum Tax	10%	25%	6%
Lower Corporate Rates	-15%	-14%	-15%
Composite Effects of New Tax Rules[e]	29%	30%	29%

a. Ohio banks with assets less than $500 million.
b. Ohio banks with assets greater than $500 million.
c. Estimated effects of disallowance of municipal interest expenses with the new tax law's grandfathering provisions.
d. The new tax code exempts this class of banks from these tax provisions.
e. The composite effects of the new tax code include the foreign tax credit transition rule, the grandfathering of tax-exempt municipal interest expense, and the exclusion of small- and medium-size banks from repeal of the bad-debt tax reserve.

Source: Consolidated Report of Condition and Income, December 31, 1985.

TABLE 3

could affect the tax liabilities of Ohio banks. In interpreting the results, it should be pointed out that the simulated effects of each tax-reform provision estimate how each tax change potentially could alter the Ohio banks' federal income tax liability, assuming all other provisions of the old tax law remain in effect. After isolating the effects of each individual tax provision, we simulate what potentially could happen to tax burdens when we impose all the new tax rules simultaneously on the Ohio banks.

The adverse effect of eliminating the deduction for municipal-securities-interest expense on Ohio banks' tax liabilities is lessened considerably because the new tax rules grandfather municipal bonds acquired before August 8, 1986. If the new tax law had disallowed the municipal-securities-interest-expense deduction entirely, the tax liability of all Ohio banks in 1985 would have increased by 42 percent—and even more for small- and medium-size Ohio banks (49 percent)—assuming that no other tax code provisions were changed (see table 3). Because small- and medium-size Ohio banks, on average, hold a higher percentage of their assets as municipal obligations, they will incur a slightly higher relative tax liability from this single tax law change.

However, under the grandfathering provisions of the new tax law, we assume that Ohio banks will retain at least 90 percent of their present municipal-securities-interest-expense deduction in 1987. According to our simulated results, Ohio banks would have had a tax liability in 1985 that was only 4 percent higher than if they had included 10 percent of securities interest expense in their taxable income. Our simulations do not allow for the substitution of the maturing tax-exempt assets into higher-yielding taxable assets. The higher portfolio returns from taxable interest-bearing assets will boost before-tax income and will provide an offset to higher taxes.[2]

Loan-Loss Reserves. Under the old tax rules, commercial banks, like other corporations, can deduct contributions to a bad-debt reserve for tax purposes, rather than deduct debts when they become uncollectible. Unlike other corporations, however, banks must report a loan-loss provision *for regulatory purposes* that differs from the amount reported for tax purposes. The level of the regulatory reserve, which in recent years has exceeded the amount that is tax deductible, is based on examiners' appraisal of the quality of each bank's loan portfolio.

The old tax law required that a commercial bank determine its bad-debt reserve deduction for tax purposes by using one of two methods: the *experience* method or the *percentage* method. Under the *experience* method, a bank bases its loan-loss deduction on the average loan losses of the previous six years. Under the *percentage* method, a bank deducts provisions to a loan-loss reserve equal to 0.6 percent of eligible loans outstanding.

Under the new tax rules, large banks will be permitted to take deductions for bad debts only when loans become partially or wholly worthless. Many bank tax observers believe that this will accelerate charging off bad debts by large banks.[3] Even ignoring the tax consequences that repealing the bad-debt reserve provision will have for large banks, there might be prudent reasons, according to these observers, for retaining the bad-debt reserve for *all* banks. The rationale for this argument is that most banks operate under accrual accounting standards and, as a consequence, bank income is taxed whether or not it is received. If loans are charged off only when they become uncollectible, a bank would mismatch its expenses and income. This mismatch could be avoided by establishing a proper bad-debt reserve that represented the present value of economic losses already embedded in a bank's loan portfolio. However, neither tax accounting rules nor generally accepted accounting principles (GAAP) adjust future losses to their present values.

Under the new tax code, large banks (banks with assets over $500 million) also must recapture their existing bad-debt reserves by reporting them as income over the next four years —10 percent in 1987, 20 percent in 1988, 30 percent in 1989, and 40 percent in 1990.[4] The new

2 See O'Brien, James M. and Matthew D. Gelfand, "Effects of the Tax Reform Act of 1986 on Commercial Banks." O'Brien and Gelfand's results allow for the substitution of maturing tax-exempt bonds into taxable interest-bearing obligations. According to their simulations, the higher taxable yields would substantially offset the significant increase in bank taxes.

3 Proponents of the loan-loss reserve method of accounting for bad debts contend that if commercial banks were allowed to charge off loans only when they become bad, we might recreate the pre-1921 atmosphere of dispute between banks and the Internal Revenue Service (IRS). Prior to 1921, when banks had to write off bad loans either in full or not at all, there were constant disputes between banks and the IRS about the timing of the deduction for bad loans. It has recently been argued that this claim is incorrect. To the contrary, the repeal of the tax bad-debt reserve method will eliminate the incentive to accelerate loan chargeoffs. See Neubig, Thomas S. and Martin A. Sullivan, (1987).

4 Commercial banks have two other options for recapturing existing reserves under the new tax rules. One option permits a bank to recapture more than 10 percent in 1987 and then recapture the remaining reserve as follows: 2/9 in 1988, 1/3 in 1989, and 4/9 in 1990. The other option permits a bank to retain the reserve method for existing loans and to reduce the balance as loans are charged off (referred to as the cut-off method). Under the cut-off method, a bank can still deduct for tax purposes net charge-offs in excess of the reserve amount.

tax rules exempt a large bank from this recapture of bad-debt reserves only when it is *in trouble*—defined as being when a bank's nonperforming assets exceed 75 percent of its equity capital.

If we ignore the exemption of small- and medium-size banks under the new tax rules, *all* Ohio banks would have paid 7 percent more in 1985 taxes if they had written off bad loans instead of taking a bad-debt tax reserve deduction. Also, if all banks were subject to a recapture of 10 percent of their accumulated bad-debt reserve in 1985, their 1985 tax liability would have risen by approximately 12 percent.

With the small- and medium-size banks exempted, however, the estimated tax liabilities for the loss of bad-debt tax reserve and the loan-loss recapture would have been approximately 8 percent and 12 percent, respectively, for the large banks (assets over $500 million)—which are subject to exclusion of the bad-debt reserve deduction under the new tax rules.

If the new tax code had not exempted small- and medium-size banks, the recapture of 10 percent of accumulated loan-loss reserves and the nondeductibility of a bad-debt tax reserve would have affected these banks slightly less than the effect that these provisions had on the tax liability of large Ohio banks. The progressive recapture of the accumulated bad-debt reserve into taxable income, moreover, will have a significant effect on the tax liability of large banks in 1989 and 1990. If Ohio's large banks (assets greater than $500 million) had captured 40 percent of the bad-debt reserve into 1985 taxable income, this would have boosted their tax liability by almost 50 percent (see table 3, Tax bad-debt accumulated reserve, capturing 40 percent of reserve.)

Investment Tax Credits and Depreciation Write-offs. Because of ITCs and accelerated depreciation write-offs, banks have found it advantageous, from a tax perspective, to add lease receivables as a partial substitute for municipal securities and direct loans. In 1981, Congress allowed businesses to accelerate the recovery of their investments under the accelerated cost recovery system (ACRS) because the inflationary environment at that time distorted the real cost of capital. However, the inflation rate has improved significantly in recent years. As a consequence, ACRS amounts to a generous tax break because it depreciates an asset completely much sooner than the end of the asset's actual useful life. The new tax rules correct this distortion by slowing the rate of depreciation write-offs.

The elimination of ITCs, first authorized in 1962 and raised to 10 percent in 1975, will severely undercut the tax incentives of banks to engage in leasing receivables. The slowing of ACRS will have a similar, but less severe, slowing effect on the leasing activities of commercial banks. The likely response of commercial banks to the elimination of ITCs and to less-liberal depreciation write-offs should be a repricing and possible reduction of their leasing activities. On the other hand, because banks lose their interest deductions for tax-exempt bonds, they will have an incentive to reinvest some of their cash flow into leasing. Lease receivables presently represent only a small percentage of total bank assets and, on balance, the new tax rules will not cause commercial banks to add a significantly higher percentage of their assets to leasing activities.

In 1985, Ohio banks claimed almost $22 million of ITCs to reduce their tax liabilities. If they were not allowed to deduct ITCs in 1985, their tax liability would have risen approximately 13 percent.

Foreign Tax Credits. The new tax rules impose limitations on foreign tax credits (FTCs). Tighter rules on FTCs will affect primarily multinational banking organizations, particularly the New York-based money center bank holding companies. Some New York multinational banking organizations receive more than 50 percent of their reported net earnings from foreign operations or foreign assets.

Under the old tax rules, commercial banks could claim a tax credit against U.S. corporate income tax liabilities that was directly proportionate to foreign taxes that they paid. Otherwise, banks would have been taxed twice on their foreign income, once abroad and once at home. The foreign tax credit is limited to the amount of U.S. federal income taxes that, in effect, would be paid to the U.S. government on a bank's foreign income.

Because commercial banks were required to report only aggregated foreign income under the old tax rules, they could maximize their FTCs. Under the old tax rules, a U.S.-domiciled bank with international operations could originate foreign loans in a high-tax country (where the tax rate exceeded the U.S. tax rate) and in a low-tax country (where the tax rate fell below the U.S. tax rate). Because the old tax rules allowed banks to average (or aggregate) loans from both foreign countries, a bank could claim total foreign taxes as a credit on its U.S. income taxes.

Under the new tax code, commercial banks will face a new limitation on how much they will be allowed to average their tax credits from low- and high-tax foreign countries. However, there is a transition rule to allow a phase-out of the old tax rules over five years on loans extended to 33 countries (generally the high-tax countries) that currently are receiving financial assistance under written agreements with the International Monetary Fund.

The new tax provisions on FTCs will have little effect on the 1987 tax liabilities of most Ohio banks because these banks generally have low amounts of foreign assets as a percentage of total banking assets. Only the largest Ohio banks reported FTCs in 1985. Even if we estimated a worst-case situation in which FTCs are deducted from income instead of deducted from tax liability, the simulated effect on large Ohio banks' tax liability would be minor, adding only 1 percent to their 1985 tax liability.

Alternative Minimum Tax. Commercial banks now pay what amounts to an add-on tax of approximately 15 percent of the amount by which selected preference items or deductions exceed either $10,000 or a bank's net tax liability.[5] The selected preference items include capital gains, accelerated depreciation, and excess loan-loss provisions. The purpose of this add-on tax is to counteract the effect that tax-preference items have on reducing taxable income.

In 1985, add-on taxes represented, on average, less than $1 million of the net tax liability of all sampled Ohio banks (see table 2, line 5). Our estimations of add-on taxes for Ohio banks are low because they exclude capital gains and excess accelerated depreciation as part of the add-on tax base. Neither category can be estimated with any reasonable accuracy from available financial data. However, this does not result in seriously underestimating the add-on taxes of Ohio banks, because capital gains and excess accelerated depreciation are typically small additions to the add-on tax base of most Ohio banks. It is worth noting that banks report all securities gains, regardless of the length of time held by them, as ordinary income for tax purposes.

Tax reform repeals the present add-on tax and replaces it with a new alternative minimum tax (AMT) that imposes a strict minimum tax of 20 percent. To compute the AMT, a bank must add together its regular taxable income and certain tax preferences that represent its alternative minimum income. After exempting $40,000 of this amount, a bank must multiply its alternative income by 20 percent; its tax will be the greater value either of its regular tax or of the AMT. The tax preferences include bad-debt reserves in excess of the deduction based on the experience method (small- and medium-size banks only); interest income on private-purpose, tax-exempt bonds issued after August 7, 1986; and 50 percent of book-value income that is not already subject to the minimum tax that will include, for the most part, tax-exempt income for banks.

Our simulations indicate that the AMT will have less effect on large Ohio banks than on small- and medium-size Ohio banks. The elimination of tax preferences ensures that the large Ohio banks will pay at least the minimum tax amount. Our simulations indicate that the AMT would represent only 8 percent of all Ohio banks' total tax liability. However, for small- and medium-size banks, the AMT will represent a significantly higher proportion (almost 21 percent) of their estimated 1985 tax liability under the new tax provisions.

During the next four years, the recapture of existing loan-loss reserves by large banks will gradually boost their taxable income. Consequently, large Ohio banks will almost assuredly, on average, pay the top marginal tax rate. For small- and medium-size Ohio banks, the AMT will be a much larger percentage of net taxes for two reasons: (1) these banks retain more tax preferences and (2) they have relatively more book-income adjustment as a result of their relatively larger holdings of municipal securities.

Net Operating Loss Carry-overs. Under present tax law, corporations may carry over current net operating losses (NOLs) to offset tax liabilities in past and future years. Most corporations are allowed to carry losses back three years and to carry them forward 15 years (losses must be carried back first). Banks, however, are allowed to carry NOLs back 10 years and forward five years. Banks received favorable treatment of NOLs at a time when Congress was reducing the reserve allowance that was permitted for bad debts. Consequently, if a bank incurred an unusually large debt write-off, favorable treatment of NOLs would reduce the financial strain on the bank.

The new tax code retains existing NOL rules for pre-1987 losses. NOLs arising in 1987 and thereafter will be subject to the same rules that apply now to other nonfinancial corporations. However, existing NOL rules will be retained for some losses occurring after 1987, but prior to 1994.

The special NOL rules that now apply to depository institutions provide a cushion against large current losses. Under present NOL rules, a bank receives a tax savings immediately because operating losses are carried back 10 years to reduce past tax liabilities. Moreover, the prospect of future earnings against which carry-forwards could be offset is not certain for many banks. The effect of adopting the new rules is that carry-overs would reduce future tax liabilities more than past tax liabilities. What this means is that the new NOL rules will provide less assistance to financially ailing banks.

401(K) and IRA Programs. A section 401(K) plan is an employer-sponsored program under which employees can defer a portion

5 See Ernst & Whinney, Tax Reform—1986, An Analysis of Provisions Relating to the Financial Services Industry, p. 18.

of their pay in investment accounts until retirement under that provision of the Internal Revenue Code. IRAs are deposits in individual retirement accounts that are deductible from current income.

Under the new tax code, high-income taxpayers who are covered by a pension plan would forgo the tax deduction for an IRA. However, individuals who are not covered by employer-maintained retirement plans, including 401(K) plans, are subject to the old tax code as it applies to IRA deductions. The new tax rules also reduce the maximum annual contribution that an individual can make to a 401(K) plan.

Annual IRA contributions will probably decline because of the new tax-code restrictions on IRAs, and banks will partially lose a stable, long-term source of deposits. The drop-off in IRAs could be offset if a supplier of IRA accounts, like a bank, could successfully encourage more lower- to middle-income individuals to use IRA accounts. Today, commercial banks and savings and loans together control almost one-third of the approximately $225 billion IRA market.

Opponents of the IRA tax changes contend that small banks could be forced out of the IRA market under the new IRA restrictions. This could occur, they argue, if the new IRA changes required banks to install sophisticated computer software to distinguish between deductible and nondeductible IRA contributions. This is not likely to happen, however, because small banks could easily purchase the necessary computer software.

IV. Conclusion

The intent of the new corporate income tax rules is to raise the federal tax liability of commercial banks. According to our simulation results, the new tax rules would have *reduced* Ohio banks' 1985 tax liabilities by approximately 15 percent if only the lower corporate tax rates were in effect at that time (see table 3). When the composite effects of the new tax rules are simulated simultaneously, however, the tax liabilities of all Ohio banks would have *increased* by almost 30 percent in 1985 under the new tax rules. This computes to an average tax rate for all Ohio banks of almost 20 percent, as compared to an actual average rate of 16.1 percent. The average tax rate of Ohio's larger banks will increase from 17.1 percent to 21.3 percent; for small- and medium-size Ohio banks, the higher average tax rate of 15.9 percent compares to an actual estimated average rate of 13.3 percent.

However, even though taxes paid by Ohio banks will likely be higher, their profitability may be largely unaffected to the extent that they can offset the higher tax expense by adjusting their lending, service prices, and other activities. Banks would pay higher taxes, but net profits could be largely unaffected because of higher pre-tax income.

Ohio's larger banks will pay progressively higher average tax rates in 1988 and in subsequent years (assuming they make no portfolio adjustments) because the new tax rules phase in several tax-increasing provisions. Large banks will gradually lose the transition rules for FTCs for developing countries and must progressively recapture existing bad-debt reserves into current income, particularly in 1989 and 1990. The loss of FTCs is of little consequence to Ohio's larger banks. However, the recapture of loan-loss reserves will boost large banks' taxable income significantly in 1989 and 1990.

The adverse effect of losing the bad-debt reserve on large banks' tax liabilities is reduced because, regardless of the Tax Reform Act of 1986, the percentage method of calculating the bad-debt provision will be eliminated after 1987, in accordance with a 1969 statute. That is, in 1988, all banks must adopt the experience method of calculating their annual loan-loss provision.

Nonetheless, the elimination of large banks' loan-loss provision for tax purposes remains a controversial issue. The traditional view of loan-loss reserves contends that its removal for tax purposes could have potentially serious consequences because such action would weaken the safety and soundness of our commercial banking system. Removal of loan-loss reserves would presumably reduce the margin of safety available to banks for coping with unexpected financial shocks.[6] Advocates of reinstating the tax deductibility of the loan-loss provision contend that it is not a tax shelter for commercial banks. Instead, the loan-loss reserve should be viewed as a proper method for commercial banks, either large, medium, or small, to amortize losses that now are embedded in their loan portfolios, and to build up reserves against potential financial strains in the future. Removing the tax deduction for a loan-loss provision for large banks gives these banks less incentive to build reserves to protect themselves against potential losses.

Those who favor eliminating the loan-loss provision argue that its loss as a tax deduction will have little effect on the safety and

6 At present, bank regulators are encouraging banks to build up their bad-debt reserves because segments of the banking industry are afflicted with problems from their foreign, energy, and farm loans.

soundness of the banking system.[7] They emphasize the fact that tax-purpose reserve positions do not determine GAAP reserve measures. In a bank's financial statements, it reports a loan-loss reserve that estimates expected future losses in its loan portfolio. For tax purposes, a bank has two choices in calculating its deductible loan-loss provision: (1) it can deduct its actual losses, or (2) it can deduct a maximum percentage of its eligible loans or deduct the average of current loan losses and previous five-year losses. Since tax and accounting rules for bad-debt reserves differ, the reserve method would not change a bank's provision for bad debt in its financial statement.

Given this, the effect on a bank's safety and soundness of a tax-related elimination of the loan-loss provision is pertinent only to the extent that it reduces after-tax income. Moreover, the elimination of the loan-loss provision, or even the recapture of existing loan-loss reserves per se is not the relevant issue, but rather how the new tax law's combined provisions will affect total after-tax bank income. To the extent that after-tax bank income is largely unaffected by the tax provisions, there would be little effect on the soundness of the banking system.

Proponents of eliminating loan-loss-reserve deductibility further claim that bank soundness will not be impaired because the removal of any tax incentives to bolster loan-loss reserves will merely cause an accounting adjustment without causing any change in a bank's primary capital. A bank's primary capital provides a cushion of protection against loan losses. Primary capital is the sum of funds accumulated through share issuance and accumulated net earnings after dividends are paid. Those who oppose the elimination of the tax deduction of loan-loss reserves argue that it is an item that directly affects bank soundness. Proponents of eliminating the loan-loss reserve point out that the reserve is essentially an accounting tool that provides information on the expected losses incurred in a bank's loan portfolio.

For regulatory purposes, primary capital equals equity capital, plus the loan-loss reserve. Although the level of loan-loss reserves should reflect potential loan losses, a bank has some latitude to add or subtract from its loss reserves. If there are tax incentives favoring loan-loss reserves, then a bank would find it desirable to adjust its accounting statements to report a larger provision. It would be desirable from the bank's perspective to increase the reserve provision by making an accounting adjustment to its equity capital so that the bank did not increase its primary capital.

If a higher level of primary capital is desired by a bank, it has two options: issue additional equity or capital-qualifying notes, or reduce dividends. Whether a bank issues additional equity or capital-qualifying notes, however, will depend critically on market conditions and on the bank's financial condition, and is not a consequence of how the bank reports its accounting statements. It follows that if tax incentives to add book loan-loss reserves are eliminated, a bank would adjust its accounting statements and would not alter its capital position.

7 For a complete discussion of this view, see O'Brien, James M. and Matthew D. Gelfand, "Effects of the Tax Reform Act of 1986 on Commercial Banks," 1987 Tax Analysts, Tax Notes, February 9, 1987, Special Report #1.

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