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Chapter 7

MONITORING INTERNATIONAL TRADE FLOWS WITH LEADING INDICATORS

Several books produced at the National Bureau of Economic Research in the 1950s explored the application of the Mitchellian perspective in studies of international trade. In 1959, for example, Oskar Morgenstern published *International Financial Transactions During Business Cycles.*[1] Ilse Mintz's trade studies examined the potential impact of external trade on U.S. domestic cycles, which led to her seminal works on growth cycle measurement. In several papers prepared for the NBER and published between 1959 and 1967, Mintz noted that there were good reasons to believe that fluctuations in world imports would be closely related to fluctuations in U.S. exports.[2] Although domestic supply and demand affect the volume of U.S. exports, world demand, as represented by world imports exclusive of U.S. imports, was expected to have a significant influence on export volume and export prices. Mintz proceeded to test this hypothesis with data on U.S. export quantities, unit values, and total values from 1881 to 1961, examining total exports and exports of finished manufactures, semi-manufactured goods, crude materials, and foods.

For each of these groups Mintz found a consistent, positive relationship with world imports. During expansions in world imports, U.S. export quantities, prices, and values rose; during contractions in world imports, they fell (or rose at a slower rate). And the relationship persisted—it applied to the period 1881-1913 and to the period 1921-61. For the value of total U.S. exports, it applied to every

single cycle in world imports during both these periods. For prices and quantities of total exports, it applied to every cycle in world imports after 1921, and to a clear majority of cycles before then. The relationship was somewhat weaker for prices than for quantities, and somewhat weaker for food than for the other products. But in general the relationship held.

In considering ways in which we could test and possibly elaborate upon Mintz's findings, we began by examining patterns emerging from trade between the United States and several of the larger market-oriented economies for which an indicator system had been developed.

We discovered that spurts and recessions in growth have had a marked effect on the volume of both exports and imports. U.S. exports to Canada, the United Kingdom, West Germany, and Japan, for example, grew almost six times as fast when those countries were in an expansion phase of their growth cycle than when they were in a contraction phase. Similarly, exports out of these countries and into the United States (our imports from them) grew more than three times as fast during upswings in the U.S. growth cycle as during its downswings. As a result, movement in our trade balance has been profoundly affected by whatever differences may occur in the timing and severity of recessions and recoveries here and abroad.[3]

As shown in Part A of Table 7-1, during three recent upswings in Japan (1959-61, 1962-64, and 1966-70), our exports to Japan grew at an average rate of $2.7 million a month. But, during the three Japanese downswings (1961-62, 1964-66, and 1970-72), they actually declined slightly, by an average of $0.3 million a month. U.S. exports to the four countries combined grew at an average rate of over $11 million per month during growth cycle upswings, as compared with U.S. export growth averaging only $1.9 million per month during growth cycle downswings. Overall, U.S. export growth during upswings in foreign growth cycles exceeded export growth during adjacent downswings in eighteen out of the twenty possible comparisons. In contrast, and as expected, the relationship of U.S. exports to U.S. growth cycles is not as systematic.[4]

U.S. imports from all four countries combined grew at an average rate of nearly $18 million per month during the five U.S. growth cycle upswings, but at less than a third that rate, $5½ million per month, during the four downswings between 1958 and 1973 (Part B, Table 7-1). The average rise in U.S. imports from Japan, for example, was $5.4 million per month during U.S. upswings, but only $1.5 million per month during U.S. downswings. The fluctuations in our economic growth rate are as important to Japan as their fluctua-

Table 7-1. Changes in U.S. Exports and Imports During Growth Cycles: Monthly Data.

Part A. Changes in Exports during Foreign Growth Cycles

U.S. Exports to:	Average Number of Months in Foreign Growth Cycle		Average Change per Month in U.S. Exports during Foreign Growth Cycle[a] (millions $)			Conformity Index[b]
	Upswings	Downswings	Upswings	Downswings	Ratio Upswing/Downswing	
Japan, 1959-72	34	18	+2.7	-0.3	—[c]	+100
United Kingdom, 1958-72	28	25	+1.4	+0.2	7.0	+100
West Germany, 1959-73	25	22	+3.0	+0.3	10.0	+67
Canada, 1958-70	18	19	+4.0	+1.7	2.4	+71
Total			+11.1	+1.9	5.8	

Part B. Changes in Imports during U.S. Growth Cycles

U.S. Imports from:	Average Number of Months in U.S. Growth Cycle		Average Change per Month in U.S. Imports during U.S. Growth Cycle[a] (millions $)			Conformity Index[b]
	Upswings	Downswings	Upswings	Downswings	Ratio Upswing/Downswing	
Japan, 1958-73	24	14	+5.4	+1.5	3.6	+100
United Kingdom, 1958-73	14	14	+2.1	-0.5	—[c]	+100
West Germany, 1958-73	24	14	+2.3	+1.0	2.3	+50
Canada, 1958-73	24	14	+7.8	+3.6	2.2	+75
Total			+17.6	+5.6	3.1	

Notes:

a. Changes during upswings and downswings are measured from three-month averages of seasonally adjusted data centered on growth cycle peaks and troughs.

b. A slower rate of growth during a growth cycle downswing than in an adjacent upswing is counted as an instance of positive conformity, the opposite as negative conformity. The number of positive instances minus the number of negative instances, divided by the total number, times 100, is the conformity index. It can range from +100 to -100.

c. Denominator of ratio is negative.

Table 7-2. Changes in U.S. Exports and Imports during Growth Cycles: Annual Data (Annual changes in millions of dollars).

	Changes during Importing Country's Growth Cycle				*Changes during Exporting Country's Growth Cycle*			
	Period Covered	*Upswings*	*Downswings*	*Conformity Index*[b]	*Period Covered*	*Upswings*	*Downswings*	*Conformity Index*[b]
U.S. Exports to:								
Japan	1954-72	+393	-87	+100	1952-73	+285	+304	0
United Kingdom	1951-72	+176	+4	+100	1952-73	+184	-5	+67
West Germany	1952-73	+355	+38	+56	1951-73	+172	+67	+33
Canada	1950-70	+555	+86	+82	1951-73	+622	+10	+85
Total[a]		+386	+25	+83		+316	+91	+47
U.S. Imports from:								
Japan	1952-73	+485	+184	+83	1954-72	+258	+579	-75
United Kingdom	1952-73	+191	+1	+83	1951-72	+176	+90	0
West Germany	1951-73	+249	+118	+83	1952-73	+378	+179	+11
Canada	1951-73	+642	+287	+69	1950-70	+524	+376	+64
Total[a]		+392	+153	+80		+356	+252	+6

Notes:
a. Based on all available annual changes for the four countries.
b. See note (b) to Table 7-1.

tions are to the United States. Similar comments can be made about the three other countries covered in the table.

Annual export and import data, which extend further back than the monthly data used in Table 7-1, confirm and extend these findings (Table 7-2). The left-hand section of the table shows that U.S. trade with each of the four countries and with the four combined is greatly influenced by the state of the growth cycle in the importing country. The right-hand section, on the other hand, shows that conformity to the growth cycle in the exporting country is decidedly mixed. Where relations between growth cycles in the two trading countries are close, as in the case of the United States and Canada, good conformity of exports to the exporter's growth cycle may simply reflect the fact that the importer's and exporter's cycles are very similar.

In contrast, U.S. exports to Japan are unrelated to the U.S. growth cycle, whereas Japan's exports to the United States are inversely related to Japan's growth cycle. When the Japanese economy is growing rapidly, Japan imports more from the United States and exports less to the United States. During downswings in the Japanese growth rate, Japan imports less from the United States and exports more.

In short, we find that the volume of exports is clearly influenced by the state of the growth cycle in the *importing* country, but not consistently related to the state of the growth cycle in the *exporting* country. This no doubt reflects the complexity of the relationship between exports and the exporting country's business cycles: some countries, for example, are more dependent upon foreign trade than others. However, Table 7-2 does suggest that trade balances (exports minus imports) conform inversely to growth cycles in each of the four countries, due to the more rapid growth of imports during the upswing phase of the importing country's growth cycle.

Putting all these results together, it appears that growth cycles exert a powerful influence upon the volume of trade—a useful fact for trade analysis and all the more significant because consideration of trade flows played no part in the identification of growth cycle turning points.

THE USE OF LEADING INDICATORS IN FORECASTING CHANGES IN TRADE FLOWS

One of the implications of the above findings, in conjunction with those reported in earlier chapters, is that we should be able to utilize the leading indicators as an early-warning system to forecast

changes in foreign trade flows. A country's demand for imports is likely to closely follow fluctuations in its domestic economic fortunes. Imported materials are used in domestic production, and imported finished goods are sold directly in domestic markets. The leading indicators include a number of factors pertaining to these demands for imports: orders placed for goods in the importing country; the accumulation or liquidation of inventories; marginal adjustments in the utilization of labor (e.g., by shortening or lengthening the workweek); prices paid for industrial materials; new commitments to invest in plants and equipment; and price/cost relations affecting profit margins. These are not the only elements bearing upon decisions to import, of course, but they are sufficiently important to have a significant relationship to import demand.

The leading indicators can be used either to forecast aggregate demand and the latter used to forecast imports, or they can be used to forecast imports directly. We have chosen the direct route in the experiments described below. The system can be applied to exports as well as to imports, provided the exports go to countries represented in the leading indexes. Hence, it can be used to obtain forecasts of trade balances among these countries.

The forecasts are limited in nature, since the leading indexes do not lead aggregate demand (or imports) by more than four to six months on the average. Nevertheless, the system can be used to forecast next year's trade at the end of the preceding year, and predict the rate of trade growth three or four quarters ahead of the latest available data.

Methodology

The variable we have chosen to illustrate the forecasting technique is the percentage change in U.S. exports. Forecasting change is more challenging than forecasting levels, because levels are often largely dominated by long-run trends. We have experimented with both annual and quarterly forecasts and report here on our efforts regarding manufactured goods exports as a whole and several commodity groups. Exports can be measured in terms of quantity, unit value, and total value, and we have experimented with forecasting all three. We shall concentrate on quantity forecasts. The forecasts themselves are generated by the percentage change in the leading index for the country (or countries) to which U.S. exports are going. The index is assumed to lead the flow of exports into the area under review by six months.

The percentage change in the leading index is the independent variable. For annual (calendar-year) forecasts, the six-month lead

implies that changes in the leading index between fiscal years (years ending June 30, overlapping the calendar years by six months) are required. In order to make forecasts before the calendar year has begun (or rather, before data for any part of the calendar year are available), we assume that the fiscal year overlapping the calendar year to be forecast can be approximately represented by the December figure for the leading index. This is (approximately) the central month of the fiscal year. Thus, to forecast the percentage change in exports from year (1) to year (2) we may use the percentage change between the average value of the leading index for the fiscal year average ending June 30 of year (1) and its value in December of year (1). This measure is the twelve-month change, smoothed. An alternative, which we have come to employ more frequently, is the six-month change, smoothed. It consists of the percentage change in the index from an average of the twelve months immediately prior to the current month and hence is more up-to-date than the smoothed twelve-month change. No data for year (2) are employed in the forecast. We further assume a linear relationship between the percentage changes in exports and in the leading index. Our regressions are of the form:

$$\Delta Q_t = a + b\Delta LD_{-1}$$

where ΔQ_t is the percentage change in export quantity from year $(t-1)$ to year (t), and ΔLD_{-1} is the percentage change in the leading index between the fiscal-year average and December of year $(t-1)$. A simple adaptation of this scheme enables us to apply it to quarterly data.

Wherever we use composite leading indexes for several countries the indexes are usually weighted by the country's GNP in 1970, expressed in U.S. dollars. The broadest group includes the six largest countries considered in this book: Canada, the United Kingdom, West Germany, France, Italy, and Japan. These countries collectively took 51 percent of total U.S. exports in 1970, and 47 percent of U.S. manufactured goods exports. Another group includes only the four European countries in the above list. At various times we have employed export weights rather than GNP weights, but the difference in results is usually not substantial.

By means of this method we obtain an independent variable based on percentage changes in the leading indexes of U.S. trading partners and use it to forecast subsequent percentage changes in U.S. exports to these countries. The size and significance of the correlation coefficients and mean errors thereby constitute a measure of the success obtained by this simple forecasting technique.

We have not been able in all instances to match the geographic coverage of the export data with that of the leading indexes. Thus, we have used the composite leading index for four Western European countries to forecast exports to all Western European countries. Also, we have used the six-country composite index to forecast total U.S. exports to all countries. We experiment briefly as well with the reverse—forecasting the exports from several other countries. There is a possible source of error in these experiments, though the possibility is somewhat mitigated by the likelihood that some of the countries not covered by our leading indexes may experience cyclical movements similar to those that are covered.

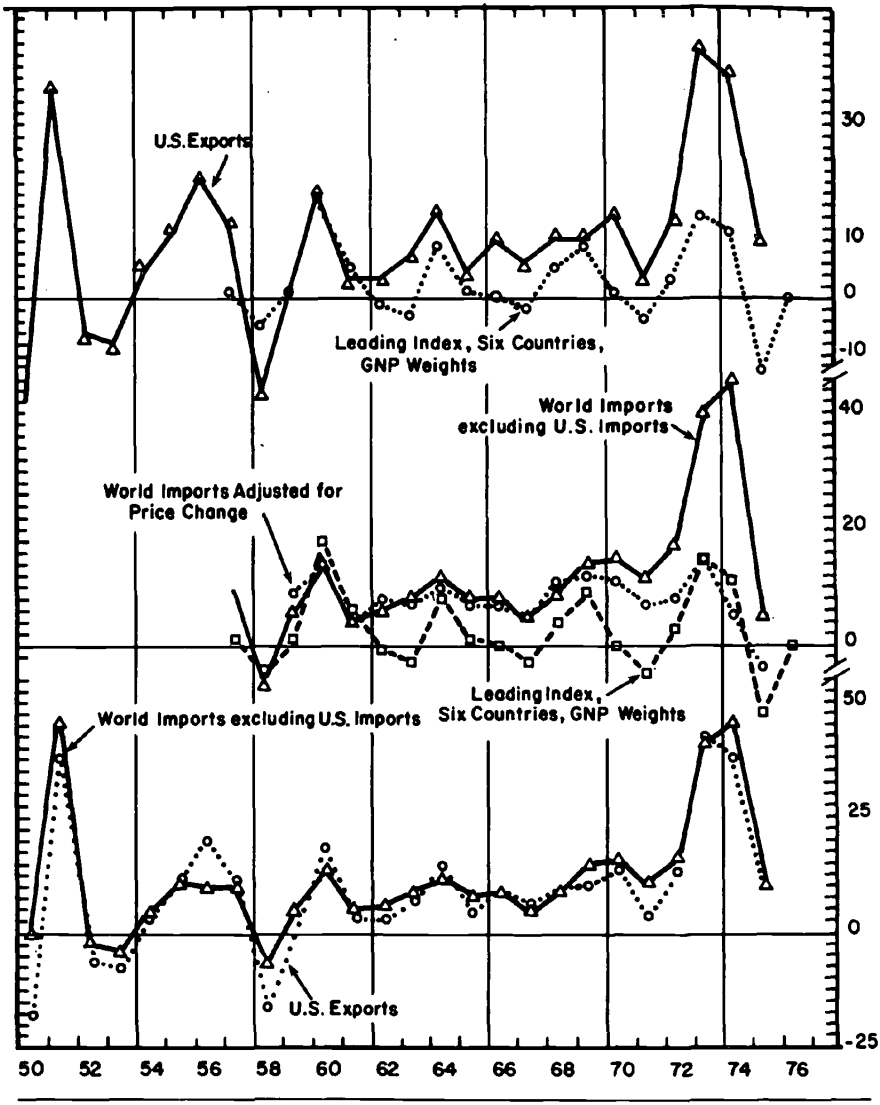
In the remainder of this chapter we shall first examine the use of world imports as a way to forecast U.S. exports. Then we will show how leading indicators can be used to forecast (1) annual U.S. export quantities, (2) annual exports from other major market-oriented economies, (3) annual exports of selected U.S. manufacturing and commodity groups, (4) annual exports of developing countries to all countries, and (5) quarterly U.S. imports, exports, and trade balances.

USING WORLD IMPORTS TO FORECAST U.S. EXPORTS

One of the implications of Mintz's research was that if a way could be found to forecast world imports, it should provide useful forecasts of U.S. exports. To this end we have examined the relationship of world imports to U.S. exports in recent years to test Mintz's theory and the relationship between our leading index for six major industrial countries and world imports (excluding U.S. imports) to see whether, despite the limited geographic coverage of the leading index, it has some ability to forecast world imports.

Figure 7-1 (bottom panel) reveals that the close relation between changes in world imports and U.S. exports that Mintz found for 1881-1913 and for 1921-61 has persisted. The correlation (r^2) is 0.92 for 1955-75.[5] The middle panel of the figure shows that the prior changes in the six-country leading index are moderately related to world imports. The correlation (r^2) is 0.32 for 1957-75 and is statistically significant. Since 1962, however, the rate of change in world imports has always exceeded the rate of change in the leading index. One important reason for this is that the world import data are in current prices while the leading index is in physical units or constant prices. World inflation has increased the value of world imports since the 1960s. A rough allowance for this can be made by

Figure 7-1. Annual Percentage Changes in World Imports, U.S. Exports, and Six-Country Leading Index.



adjusting world imports for price changes, as shown by the dotted line in the middle panel.[6] With this adjustment, correlation with the prior changes in the leading index is increased (to 0.52), implying that about half the variance in the year-to-year changes in the volume of world imports is accounted for by the six-country leading index.

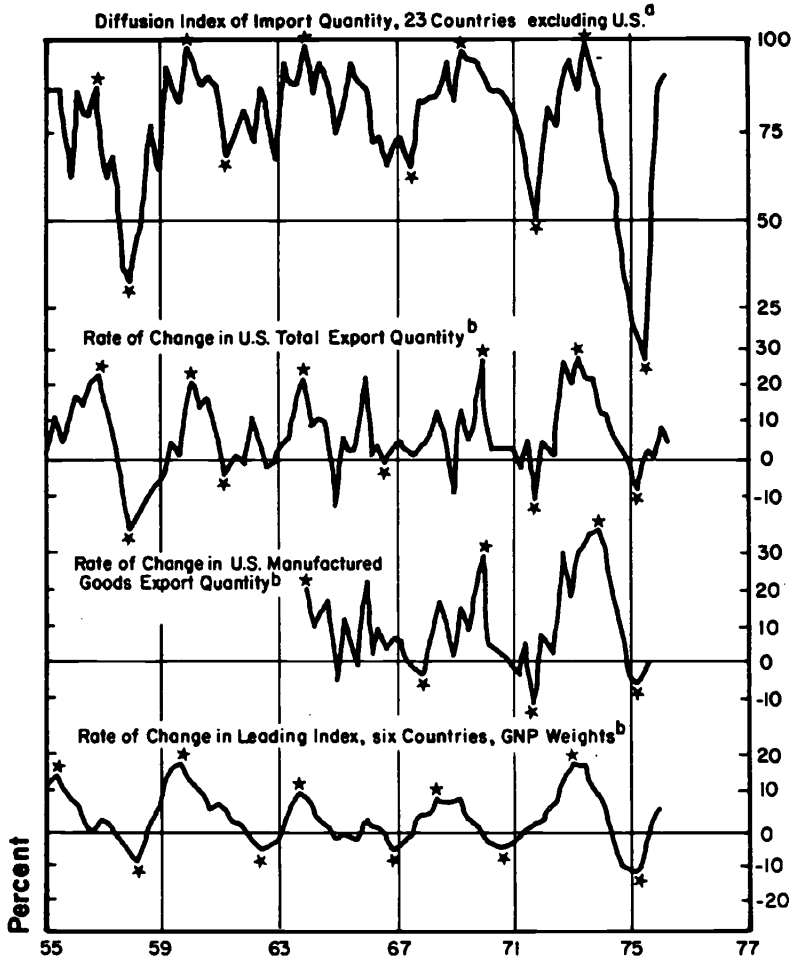
In the upper graph of Figure 7-1, the changes in U.S. exports and the prior change in the six-country leading index are brought together. Again, the rate of increase in U.S. exports exceeds that in the leading index every year since 1962, largely because of the inflation in export prices. The correlation (r^2) is 0.69, which means that the leading index accounts for nearly 70 percent of the variance in the year-to-year changes in U.S. exports. The leading index is more closely related to U.S. exports than to world imports.[7] Hence, in this section we shall use the leading index directly rather than as an instrument for forecasting world imports. Its value for the latter purpose, however, should not be overlooked by those interested in world trade as a whole.

The relation of the leading index to world trade can also be shown in another way. Mintz demonstrated that at certain times virtually all countries participate in an expansion of imports; at other times a majority experience a decline in imports. These proportions rise and fall in waves and these waves have an important impact on U.S. exports since they reflect a widening or narrowing of world demand for U.S. products.

Mintz constructed diffusion indexes, based on changes in the value of imports by individual countries, to demonstrate this phenomenon. The number of countries experiencing a rise in imports at a given time, taken as a percentage of the total number of countries covered by the data, constitutes the diffusion index. Her index covered thirty-four countries (1881–1939, 1949–53) using annual data; and thirty-five to forty-one countries (1947–53) and twenty countries (1954–61) using quarterly data.[8]

Because of the rapid rate of inflation in recent years, a diffusion index constructed from data on the value of imports would show a large majority of countries with increases most of the time. In bringing Mintz's work up to date, therefore, we have compiled indexes of the quantity, rather than the value, of imports based on records published by the Statistical Office of the United Nations for twenty-three countries (outside the United States) that issue import quantity indexes on a quarterly basis.[9] These countries imported 92 percent of the total imports of all countries outside the United States (and outside the centrally planned economies). Since the indexes are

Figure 7-2. Import Diffusion and Rates of Change in U.S. Exports and in Six-Country Leading Index.



Notes:
a. Percentage of countries with rising import quantity over same quarter one year ago.
b. Percentage change from same quarter one year ago.

not adjusted for seasonal variations, we have measured changes over the same quarter a year ago. Figure 7-2 shows the diffusion index for import quantities from 1955 to 1976.

The rate of change in the U.S. export quantity over the same quarter a year ago is also shown in the figure. A high percentage of coun-

tries with rising imports is clearly good for U.S. exports, while a low percentage is associated with poor U.S. export performance. This is what the Mintz record showed for the earlier period, and it has been just as true since then. The figure's bottom graph shows the rate of change in the leading index for six countries excluding the United States, with clear cycles related to both the diffusion of world imports and the growth rate in U.S. exports.

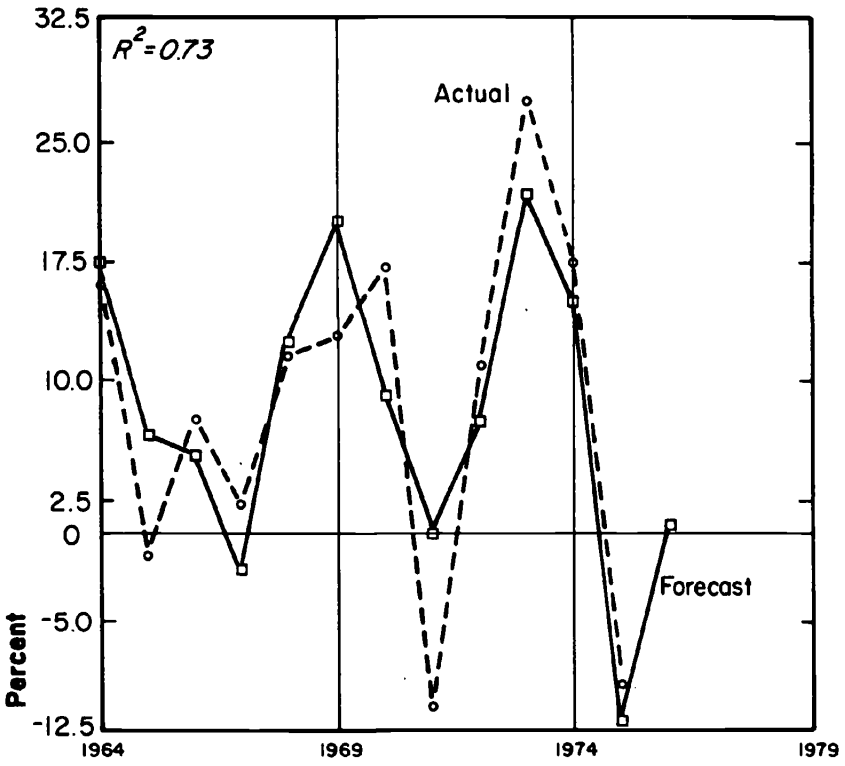
Forecasting Manufactured Goods Exports to Four Countries: Annual Data

Forecast and actual year-to-year changes in total quantity of U.S. exports of manufactured goods to Western Europe as a whole are shown in Figure 7-3. The major swings in the rates of change in U.S. exports of these goods appear to be fairly well reflected in the forecasts. The correlation coefficient (r^2) is 0.73, implying that about three-fourths of the fluctuation in the rates of change is captured by the forecasts. The root mean square error is 5.6 percentage points. The fit seems to be best during the 1973-75 period, but the correspondence is moderately good during the milder swings of the earlier years as well.

Forecasting Annual Exports for Other Market-Oriented Economies

Earlier we noted that the rate of change in the leading index for six countries other than the United States could be related to cycles in total U.S. exports. This is but one example of a general finding: Leading indexes in general anticipate the movement in coincident indicators by several months. Import demand is part of the movement captured by coincident indicators. Hence, leading indexes ought to constitute a valuable aid for forecasting exports of any country to a country or a group of countries for which such leading indexes are available. Because a composite leading index comprising six of the larger countries of the ten considered in this book represents a good part of the developed world economy we have previously noted it can be utilized to forecast total exports of any country to the "world." Figures 7-4, 7-5 and 7-6, dealing with the exports of manufactured goods of the United Kingdom, West Germany, and Japan respectively, show that the technique works quite well in all these cases to forecast their exports. The lowest correlation coefficient is .69 (for Japan) indicating that no less than two-thirds of the fluctuations in exports can be captured in the fluctuations in the leading composite index for six major countries. That the method has limitations is clear. It does not include tariff changes, supply

Figure 7-3. Forecast and Actual Percent Changes in U.S. Exports of Manufactured Goods to Western Europe, Quantity, Using Leading Index for Four Countries,[a] 1964-76.



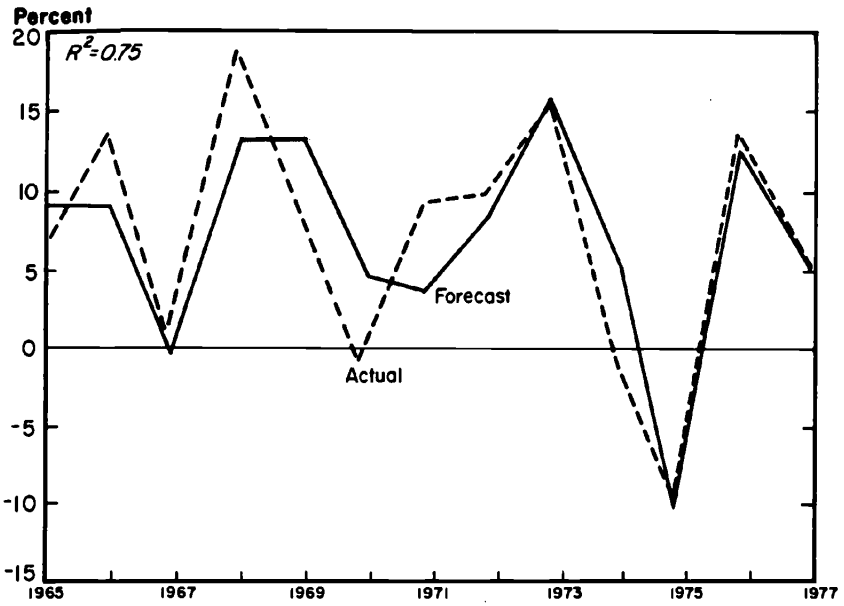
Note:
a. United Kingdom, West Germany, France, and Italy. GNP weights employed in composite leading index.

conditions, or pricing policy changes, for example. But it is useful, nonetheless.

Forecasting Exports from Developing Countries: Annual Data

A subject receiving increasing attention involves trade between developing and older industrialized market-oriented economies. Figure 7-7 illustrates that the forecasting technique under review can assist developing countries in assessing future trade with any

Figure 7-4. Forecast and Actual Percentage Changes in Quantity of United Kingdom Exports of Manufactured Goods to Six Countries, 1965-77.



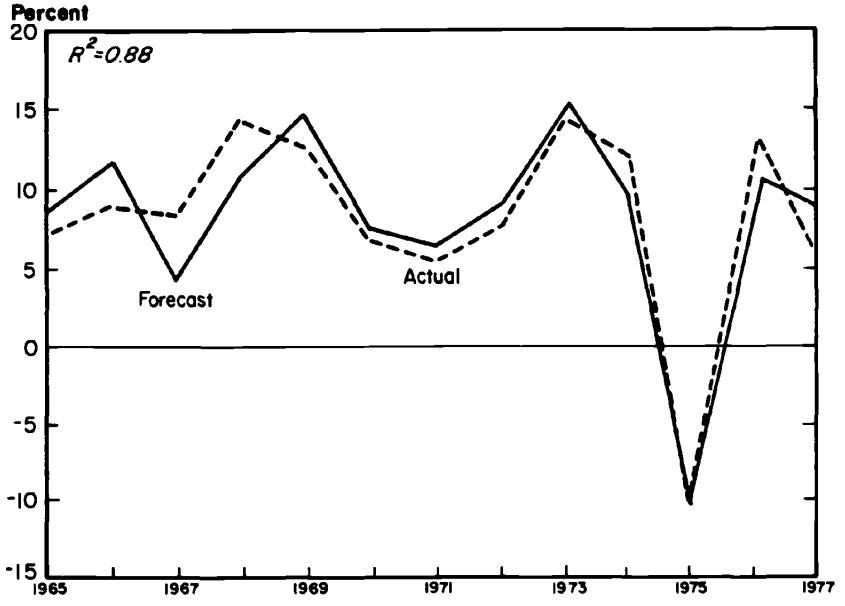
Note:
Forecasts are based on the percentage change in the leading index for six countries, weighted by U.K. exports, over the six months preceding the forecast year. The six countries and the U.K. export weights (1970) are: United States (.378), Canada (.117), West Germany (.205), France (.141), Italy (.098), Japan (.061). The regression equation (and t statistics) is: $\Delta E = 2.6 + 2.4\ \Delta Ld$, fitted to 1965-76. (1.7) (5.5)

country for which leading indicators have been constructed. Using the six major market-oriented economies to approximate the world trade of the developing economies, we can account for over 60 percent of the changes in the export trade of developing countries during the period 1964-77. The fit is better in the 1960s than in the 1970s, although the forecast clearly reflected the actual changes associated with the 1973-75 recession.

Forecasting U.S. Manufactured Goods Exports: Quarterly Data

We have utilized the general method illustrated above in a variety of tests. In one group we attempted to forecast the change in U.S. exports of several products to the world. The results are summarized

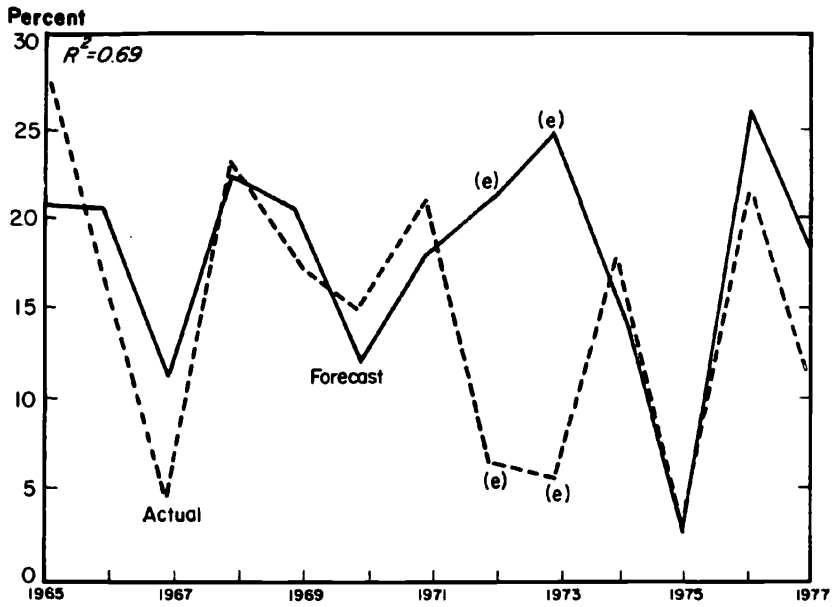
Figure 7-5. Forecast and Actual Percentage Changes in Quantity of West German Exports of Manufactured Goods to All Countries, 1965-77.



Note:
Forecasts are based on the percentage change in the leading index for six countries, weighted by West German exports, over the six months preceding the forecast year. The six countries and the West German export weights (1970) are: United States (.250), Canada (.026), United Kingdom (.098), France (.339), Italy (.244), Japan (.043). The regression equation (and t statistics) is: $\Delta E = 4.6 + 2.4\ \Delta Ld$, fitted to 1965-76.
(5.0) (8.6)

in Table 7-3 and suggest that the leading indexes can indeed be applied to forecasting trade in specific products six months ahead. Not only can the method be applied on an annual basis to individual commodities, it can also be adapted, as suggested earlier, to forecasting with greater continuity by using quarterly data. Figure 7-8 depicts the quantity of U.S. manufactured goods being exported. Recall that the change in the leading index between its average for a fiscal year and the figure for the following December is used to forecast calendar-year changes in exports, which are equivalent to changes in four-quarter averages four quarters apart. Where quarterly data are available these averages can be moved forward one quarter at a time, thereby bringing them more nearly up to date. Similarly, the changes

Figure 7-6. Forecast and Actual Percentage Changes in Quantity of Japanese Exports of Manufactured Goods to All Countries, 1965-77.



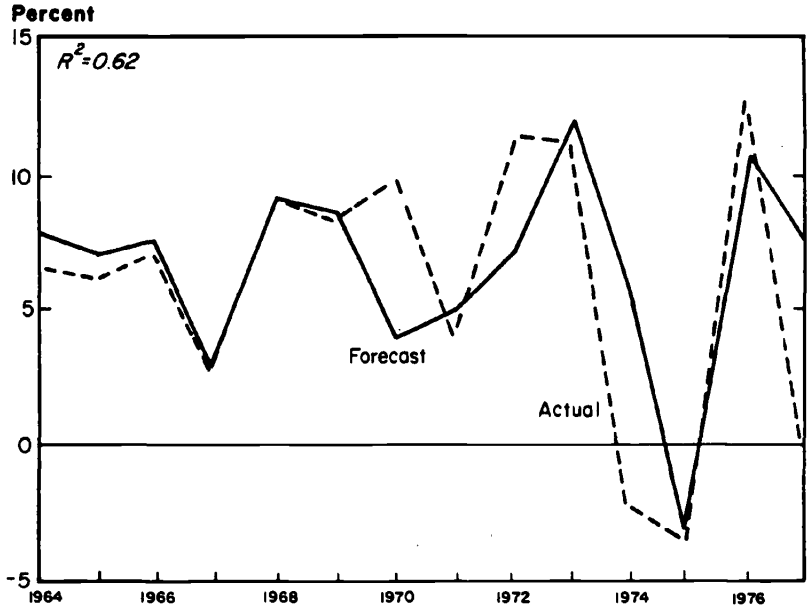
Note:
Forecasts are based on the percentage change in the leading index for six countries, weighted by Japanese exports, over the six months preceding the forecast year. The six countries and the Japanese export weights (1970) are: United States (.769), Canada (.071), United Kingdom (.061), West Germany (.069), France (.016), Italy (.024). The regression omits 1972 and 1973 (marked *e*), which were seriously affected by the dollar devaluation. The regression equation (and *t* statistics) is: $\Delta E = 15.4 + 1.8\,\Delta Ld$, fitted to 1965-76.
(9.7) (4.3)

Table 7-3. Correlation of Forecast and Actual Changes in U.S. Exports of Individual Commodities to All Countries, Using Leading Index for Six Countries, GNP Weights.[a]

Product	r^2
Chemicals (SITC 5)	0.76
Textiles (SITC 6)	0.81
Machinery and Transportation Equipment (SITC 7)	0.53
Miscellaneous Manufactures (SITC 8)	0.68

Note:
a. Canada, United Kingdom, West Germany, France, Italy, and Japan.

Figure 7-7. Forecast and Actual Percent Changes in Quantity of Exports of Developing Market Economies to All Countries, 1964-77.

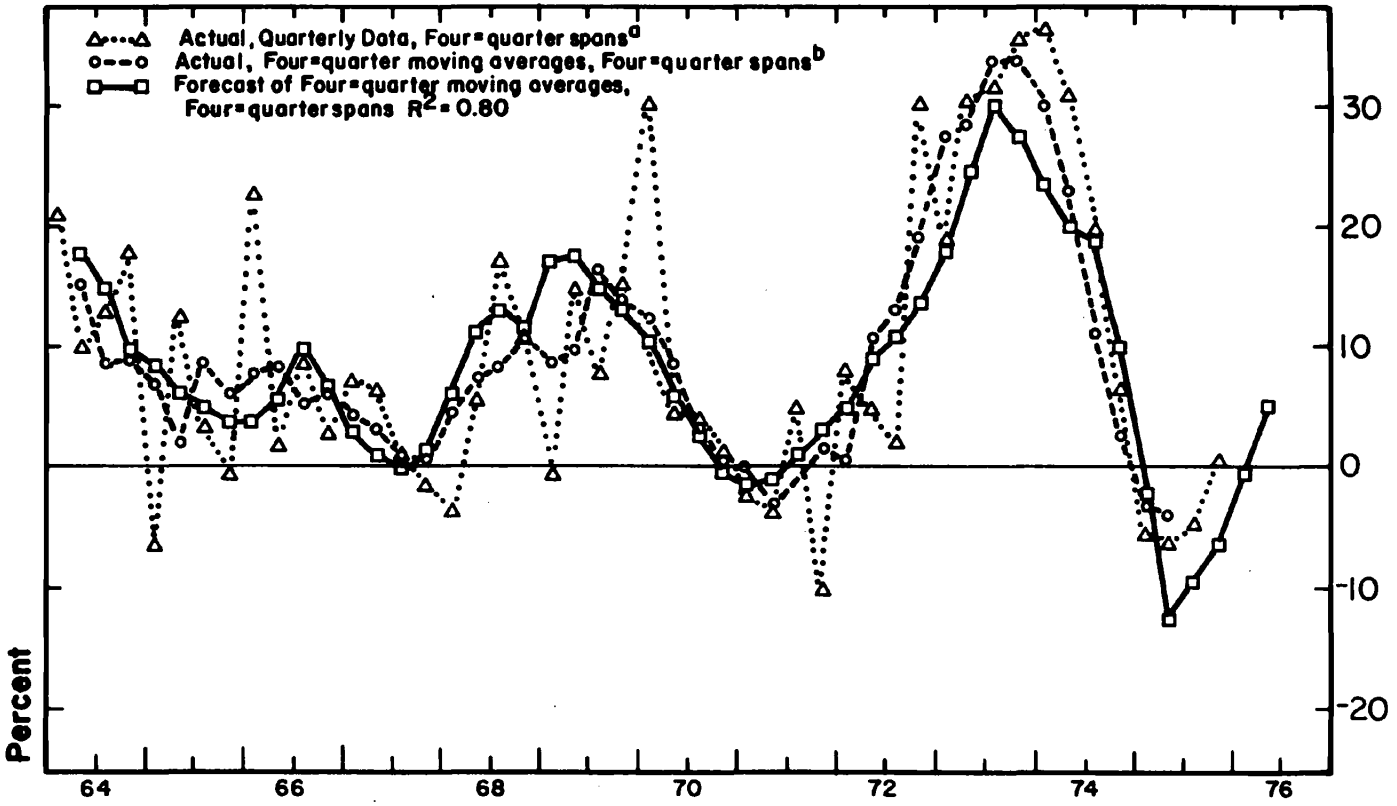


Note:
Forecasts are based on the percentage change in the leading index for seven countries, weighted by GNP weights, over the six months preceding the forecast year. The seven countries are: United States, Canada, United Kingdom, West Germany, France, Italy, Japan. The regression equation (and t statistics) is: $\Delta E = 4.2 + 0.6\,\Delta Ld$, fitted to 1964-76.
(3.9) (4.1)

in the leading index can be moved forward three months at a time so the forecasts are more up to date as well.[10]

All the data shown in Figure 7-8 are rates of change over four-quarter intervals. The dotted line is the usual four-quarter change (i.e., change from same quarter a year ago), plotted in the terminal quarter of the span. These rates exhibit considerable erratic movement, since the end points are only one quarter long. When the end points are four quarters long, as in the scheme described, the rates of change are much smoother. This is shown by the solid line. Here the rates are plotted in the second quarter of the second of the two four-quarter periods compared. For example, the change from calendar-year 1963 to calendar-year 1964 is plotted in 1964.2. This is the

Figure 7-8. Quarterly Forecast and Actual Percent Changes, U.S. Exports of Manufactured Goods, Quantity.



Notes: Forecasts are based on six-country leading index, GNP weights.
a. Plotted in terminal quarter.
b. Plotted in second quarter of terminal year.

same point at which the change from 1963.2 to 1964.2 (dotted line) is plotted.

The dash line in the figure is what we attempt to forecast. The line with hollow, square points is the forecast, based on the leading index for six countries. It traces the major swings in the rate of growth of manufactured goods export quantities with considerable fidelity and identifies the cyclical peaks and troughs in these rates at about the time they occurred. The value of r^2 is 0.80 and the root mean square error is 4.3 percent.[11]

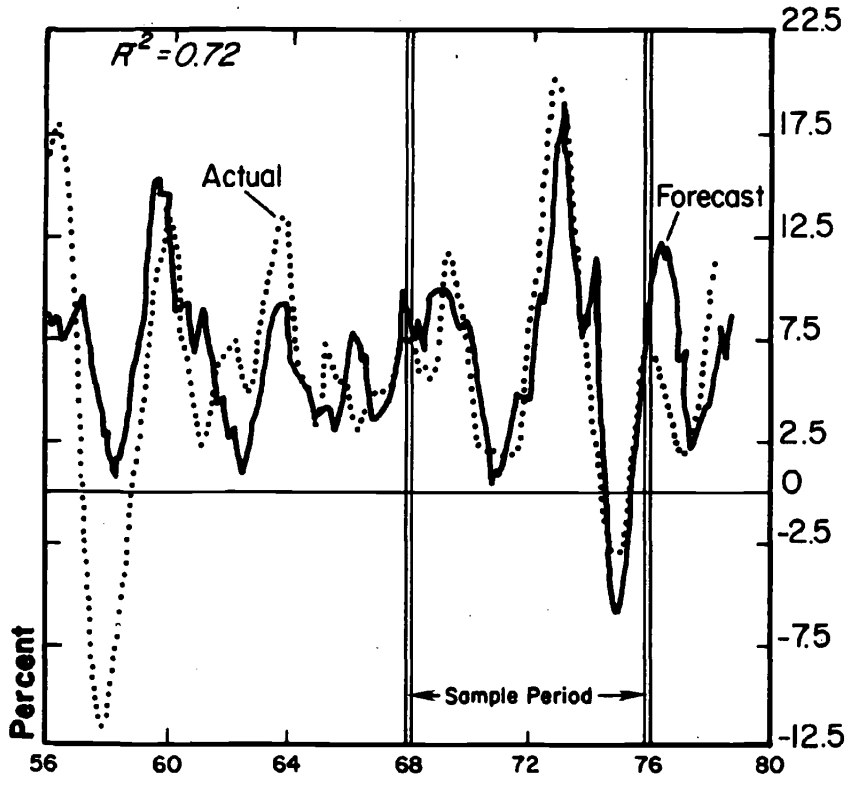
We have not carried the experiments with quarterly forecasts any further, but it is clear that forecasting exports by means of a leading index for one's export partners is eminently feasible and can be carried out both annually and with quarterly data. Much testing remains to be done.

Applications of the technique can be extended in several ways. One of the ultimate objectives of our research is to use the leading indexes to forecast trade flows in both directions and, hence, to forecast the trade balance. This can be done on a bilateral or multilateral basis. The former has the advantage in that pairs of countries can be chosen for both of which leading indexes are available. The latter has the advantage of comprehensiveness and broader interest. For the present we have chosen the multilateral approach, and have used the export and import data from the U.S. national accounts. These are available quarterly, seasonally adjusted, in constant (1972) dollars. To forecast the rate of change in import quantity we use the U.S. leading index. To forecast the rate of change in export quantity we use the leading index for six countries (excluding the United States).

Treating these data in the manner described above, we find that for the period 1968–76 the percentage change in exports is forecast with an r^2 of 0.72; the corresponding r^2 for imports is 0.59. Figures 7–9 and 7–10 show the actual and forecast rates of change during the sample period as well as before (1956–68) and after (1976–79). The cyclical swings are fairly well represented outside the sample period, but the errors of estimate are clearly much greater.

The forecast percentage changes can readily be translated into changes in billions of 1972 dollars by multiplying by the actual levels for the preceding year. Subtracting the forecast change in imports from the forecast change in exports yields the forecast change in net exports (Figure 7–11). Again, the cyclical swings are moderately well represented, both within and outside the sample period, but the r^2 is only 0.47 for the sample period and 0.31 for the entire period 1958–78.

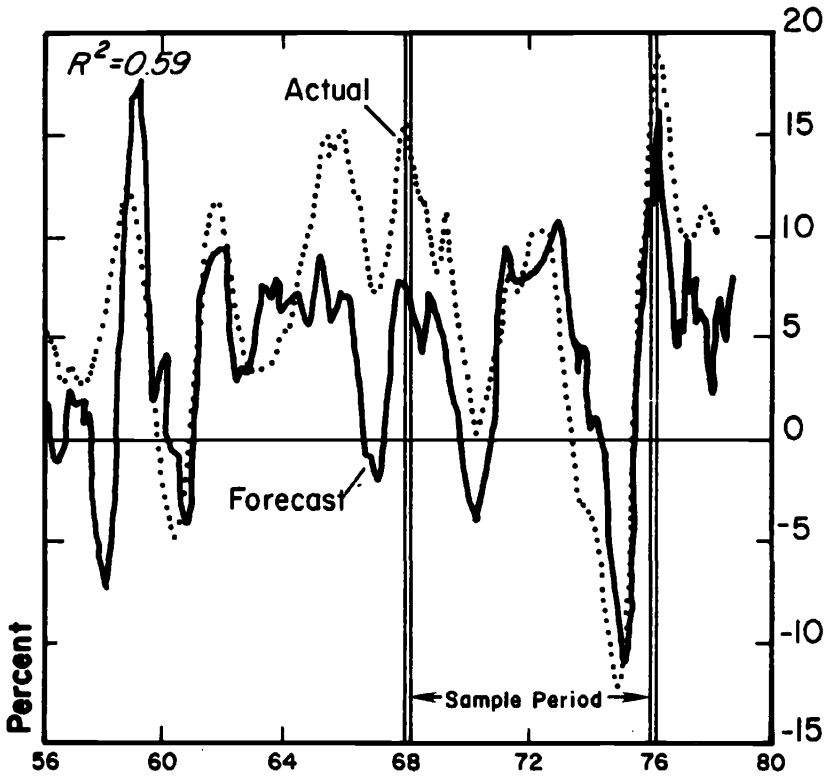
Figure 7-9. Actual and Forecast Rates of Change in U.S. Exports of Goods and Services (in 1972 $), 1956-78.



Note:
Percent change in exports is computed from four-quarter moving averages one year apart, placed in the 5th month of the second year. Forecasts are based upon percent change in leading index for six countries (Canada, United Kingdom, West Germany, France, Italy, Japan), during last six months prior to year being forecast (smoothed). Regression fitted to 1968-76.
Source: Center for International Business Cycle Research, July 1979.

We can use the forecast changes to estimate the *level* of net exports in the year ahead. As in most regressions, the closeness of fit to the levels is markedly better than to the changes, with an r^2 of 0.81 over the sample period and 0.67 over the entire period (Figure 7-12). Since the cyclical movements in the level of net exports are large, this result is rather impressive, although there is some tendency for the forecasts to lag behind the actual data.

Figure 7-10. Actual and Forecast Rates of Change in U.S. Imports of Goods and Services (in 1972 $), 1956-78.



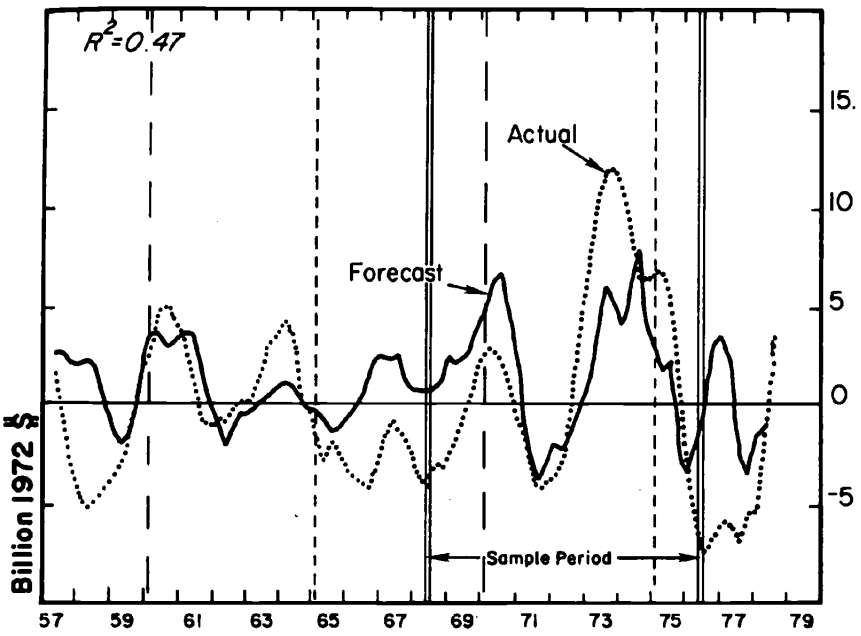
Note:
Percent change in imports is computed from four-quarter moving averages one year apart, placed in the 5th month of the second year. Forecasts are based upon percent change in U.S. leading index during the last six months prior to year being forecast (smoothed). Regression fitted to 1968-76.

Source: Center for International Business Cycle Research, July 1979.

CONCLUSIONS

Although modern market-oriented economies are clearly interrelated by much more than their trade relations, the possibility that instability can be transmitted from one economy to another via trade has long been recognized. Our consideration of this idea in the light of the growth cycle chronologies suggests that while trade is clearly a major link among market-oriented economies, no single factor can

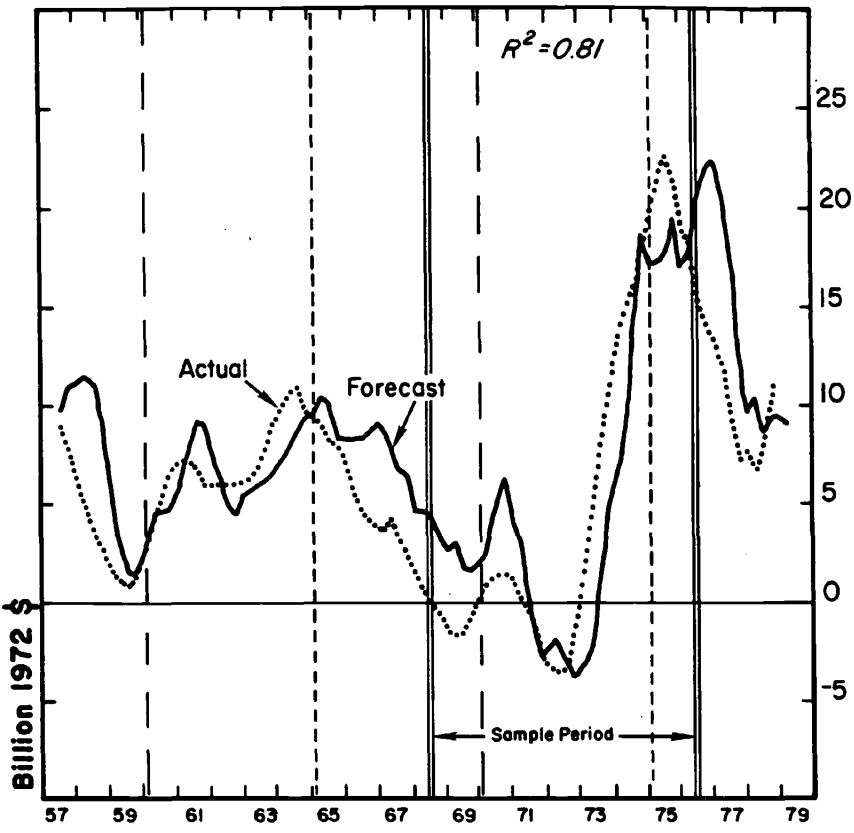
Figure 7-11. Actual and Forecast Changes in U.S. Net Exports of Goods and Services (in 1972 $), 1957-78.



Note:
Actual change in net exports is computed from four-quarter moving totals one year apart, placed in 5th month of second year. Forecast change is derived from forecast change in exports minus forecast change in imports.
Source: Center for International Business Cycle Research, July 1979.

serve adequately to explain the international path of instability. While during much of the postwar period growth cycles have been relatively synchronous (an observation made in Chapter 6), no country in our survey consistently turns down or up first. We have concluded, therefore, that the notion that cyclical disturbances invariably begin in the United States and subsequently spread to other economies, often in exacerbated form, is not borne out by the evidence. There have, of course, been peaks in U.S. growth cycles that preceded those in other economies, but there have also been times when this was not the case. We earlier established the fact that the United States has traditionally experienced more recessions than most other economies, and this alone would suggest that there must be factors that enable other economies to continue to expand, or at least to maintain previous levels during U.S. contractions. We have

Figure 7-12. Actual and Forecast Levels of U.S. Net Exports of Goods and Services (in 1972 $), 1957-78.



Note:
Actual levels of net exports are four-quarter moving averages, placed in the 5th month of the year. Forecast levels are derived from forecast changes.
Source: Center for International Business Cycle Research, July 1979.

seen as well that there are instances where other economies turned down first (frequently West Germany) or produced cycles not clearly related to U.S. cycles (in Japan, for example).

If the relationships are not simple, or exclusively determined by trade, it is nevertheless true that trade is very much affected by the state of growth cycles, and that both growth cycles and trade flows can be forecast by leading indicators.

The tests described in the preceding sections of this chapter suggest that annual forecasts of exports, imports, and the trade balance using leading indexes can account for about half the variance in the year-to-year changes in these variables. When we employ quarterly data, we find that we can account for as much or slightly more of the variance, but when we subtract the forecast changes in imports from the forecast changes in exports to obtain the trade balance the percentage of variance explained falls to well below one-half, although the cycles still show up reasonably clearly.

Much of the investigation reported here has been limited to simple, two-variable regressions between the physical volume of trade flowing to a country and a composite leading index pertaining to economic activity in one or more countries as it impinges on that country. The independent variable often used in this connection is the income or output of the country, which is supposed to generate demand for imports. Our view is that the types of economic activities represented by the leading indicators—capital investment commitments, inventory investment and purchasing, marginal adjustments in the demand for labor, profitability, and monetary and financial flows—likewise generate demand for imports, and do so at a prior date. New orders for goods usually antedate the production of goods or the income that the production generates. The accumulation of goods in inventories often precedes their sale or use in production, especially when prices are rising. These activities may lead to an increase in imports. A favorable environment for imports may also develop when the outlook for profits improves, when credit is readily available, and when confidence that these conditions will continue is high. All these factors are included among the leading indicators from which our composite indexes are constructed.

It is therefore not surprising that the regressions perform moderately well in forecasting changes in the growth rate of trade flows, both during the period to which they are fitted and outside that period. Obviously, we have not developed a complete forecasting model. The regressions take no direct account of the influence of other factors on the physical volume of trade, such as the prices of imported or exported goods and exchange rates. The unexplained portion of the variance in the growth of trade is not negligible. On the other hand, the forecasts developed in this chapter obviously are superior to a naive "no change" forecast, and the fact that they correlate significantly with the actual changes shows that they are also superior to a naive forecast based on a constant rate of growth (which would *not* be correlated with the actual changes). Forecasts

made by practitioners in this field do not always fare well against such standards. As an *Economic Report of the President* (January 1976) stated, the U.S. trade balance has "proved extremely difficult to forecast," and this has increased the difficulty of forecasting gross national product, since net exports are a highly variable constituent thereof. An appraisal of trade balance forecasts over semi-annual intervals during the period 1967–73 concluded that for most countries the forecasts were no better than those generated by a naive "no change" model.[12]

Although we have explored a number of possibilities for forecasting changes in trade flow using leading indexes, we have by no means exhausted the field. For example, focusing attention on the United States, one could attempt to forecast imports in as much detail, by country of origin, or type of commodity, as has been attempted here for exports. The forecasting errors involved in both exports and imports could be carefully examined to see whether they are related to other factors such as the competitive position of the United States vis-à-vis other economies, changes in exchange rates, and so forth.[13] Comparisons with other forecasting models could be extended in order to determine more precisely why the leading indicators technique sometimes works well and why at other times it does not. The focus could obviously be switched from the United States to any one of the other countries involved in the trade forecasts of this chapter. Indeed, since the exports of many of the developing countries are destined for one or another of the major industrial countries for which we have leading indicators, the latter's capacity to forecast the demand for the developing countries' exports could be explored further. Another area for study is the use of particular leading indicators instead of composite indexes as the forecasting instrument. Finally, the work on quarterly forecasting introduced in this discussion could be extended in many directions.

These various lines of research would require far more resources than we have been able to devote to this subject. What has already been done, however, seems sufficient to substantiate the conclusion that the use of composite leading indexes in forecasting changes in a country's trade position offers a useful new adjunct to currently available ways of forecasting changes in international trade relations. It is illustrative of the variety of uses that, we trust, will be found for the emerging system of international economic indicators.

NOTES TO CHAPTER 7

1. Princeton University Press for the National Bureau of Economic Research.

2. Ilse Mintz, *Trade Balances during Business Cycles: U.S. and Britain since 1880*, Occasional Paper No. 67 (New York: NBER, 1959); *American Exports during Business Cycles, 1879–1958*, Occasional Paper No. 76 (New York: NBER, 1961); *Cyclical Fluctuations in the Exports of the United States since 1879* (New York: NBER, 1967). Note especially the justification for using world imports rather than world income, and for excluding U.S. imports but not U.S. exports from the world total in these works.

3. These findings are in general conformity with Mintz's studies cited in note 2. They are also consistent with results reported by Arthur B. Laffer, "The Trade Balance and Economic Activity," October 28, 1974. (Unpublished.)

4. Conformity indexes relating U.S. exports to foreign growth cycles (see last column of Part A, Table 7-1) are all positive and high. Indexes relating U.S. exports to U.S. growth cycles range from negative to positive: Japan, -50; United Kingdom, +50; West Germany, -25; and Canada, +100. The high positive index for Canada no doubt reflects the close relationship between U.S. and Canadian growth cycles. Cf. also Table 7-2. The evidence on which these findings are based, presented country by country and cycle by cycle, is in Philip A. Klein, *Business Cycles in the Postwar World: Some Reflections on Recent Research* (Washington, D.C.: American Enterprise Institute, 1976) Sec. 3, pp. 37-39.

5. For U.S. exports of manufactured goods, 1957-75, the correlation with total world imports is about the same, 0.87.

6. The allowance is approximate, because we use the unit value of total world imports to adjust the value of world imports excluding U.S. imports.

7. The six countries took 51 percent of U.S. exports in 1970, and accounted for 47 percent of world imports (excluding U.S. imports) in the same year. The difference does not seem to be large enough to explain the better correlation with U.S. exports.

8. Ilse Mintz, *Trade Balances during Business Cycles: U.S. and Britain since 1880*, Occasional Paper No. 67 (New York: NBER, 1969), pp. 68-69; *Tested Knowledge of Business Cycles*, 42nd Annual Report of the National Bureau of Economic Research (June 1962), p. 8.

9. All countries with quarterly indexes of import quantities were included provided they imported at least 0.5 percent of total world imports (excluding the United States) in 1972.

10. The method has several virtues. It makes the rate of change in the exports relatively smooth, and the four-quarter moving-average technique tends to accentuate cyclical rather than irregular movements. It is also possible to vary the assumed lag between the leading index and the trade variable being forecast. While we have assumed a six-month lag in the examples in this chapter because it is reasonably satisfactory, it may very well be more appropriate in specific cases to assume other lags.

11. This is approximately the same result as for the annual (calendar-year) forecasts ($r^2 = 0.81$), as indeed it should be, since the data for every fourth observation are the same as those used in the calendar-year forecasts.

12. D. J. Smyth and J.C.K. Ash, "Forecasting GNP, Rate of Inflation, and Balance of Trade: OECD Performance," *The Economic Journal* 85, no. 338 (June 1975): 361-64.

13. In a recent study prior movements in both the leading indexes and exchange rates were found to be important. See "Forecasting Export Markets for U.S. Manufactured Goods," Center for International Business Cycle Research, Columbia University, January 1984, unpublished.