CONGRESSIONAL BUDGET OFFICE
U.S. CONGRESS
WASHINGTON, D.C. 20515

Rudolph G. Penner
Director

March 30, 1984

The Honorable Lawton Chiles
Committee on the Budget
United States Senate
Washington, D.C. 20510

Dear Senator:

In response to your request to identify the sources of the decline in U.S. trade performance and to estimate the shares of the deterioration originating in each source, we have developed the enclosed materials.

The analysis examines the deterioration in the U.S. merchandise trade balance during the period from the middle of 1980 (when the dollar began its ascent) to the end of 1983. Calculations have been performed that attribute the decline to four major sources: the strong dollar, weak foreign economic activity, the decline in U.S. exports to several large LDCs in the wake of their debt problems, and U.S. economic activity.

Given the inherent complexity of the issues and the sensitivity of the calculations to the values of the parameters employed, three sets of results have been presented. While we believe that the results of Models 1 and 2 come closest to the mark, we would caution against overemphasizing any particular set of calculations. Rather, the results are indicative of the relative contributions of the four sources that have been most important for U.S. trade performance.

Sincerely,

Rudy Penner

Rudolph G. Penner

Enclosure

cc: Honorable Pete V. Domenici

ANALYSIS OF THE DETERIORATION IN U.S. TRADE PERFORMANCE

The following analysis is an attempt to identify the main sources of decline in U.S. trade performance and to estimate the relative importance of each source.

As described in the Congressional Budget Office's The Economic Outlook (February 1984), four factors have had a major impact on U.S. trade performance: the real appreciation of the dollar against other currencies, the U.S. business cycle, the weakness of economic activity in much of the industrialized world, and the disproportionate drop in U.S. exports to several large LDCs in the wake of their debt problems. Although there is a broad consensus that these four factors have been crucial for U.S. trade performance, there is much less agreement about the quantitative significance of each.

As our initial step, we reviewed the literature on international trade to gather estimates of the responsiveness of trade flows to changes in key economic variables. Eighteen articles were reviewed in which the authors had estimated import and export price and quantity equations (see Table 1). These authors had used a wide variety of variables and data sets in their studies. This diversity, as well as lack of data documentation and availability, made it impossible to use particular authors' estimated equations as the basis for CBO's analysis.

TABLE 1. RANGE OF COEFFICIENT ESTIMATES DERIVED FROM THE LITERATURE SURVEY

Variable	Symbol	Range
Foreign income elasticity of demand	a_1	0.9 to 2.1
Price elasticity of demand for U.S. exports	a_2	-0.3 to -2.3
Elasticity of export price with respect to domestic prices	b_1	0.4 to 1.0
Elasticity of export price with respect to foreign prices	b_2	0.1 to 0.6
Export price passthrough--elasticity of export price with respect to the exchange rate	b_3	-0.3 to -0.6
U.S. income elasticity of demand	c_1	0.75 to 4.0
U.S. price elasticity of demand for imports	c_2	-1.03 to -1.73
Elasticity of import price with respect to domestic prices	d_1	0.2 to 0.6
Elasticity of import price with respect to foreign prices	d_2	0.6 to 1.0
Import price passthrough--elasticity of import prices with respect to the exchange rate	d_3	-0.5 to -1.0

As an alternative approach we have employed standard or prototype import and export equations that contain relative prices and economic activity as the independent variables. Using a range of coefficient

estimates that were distilled from the literature survey, we have employed the prototype equations to calculate a range of estimates of the effect of dollar appreciation and U.S. and foreign economic activity on U.S. merchandise trade performance.

Although we feel that this prototype approach is a reasonable one given the time and data limitations, the weaknesses of the method must be recognized and kept in mind when interpreting the results.

- No two researchers have used identical variables and data sets in estimating the coefficients of the import and export price and quantity equations. For example, we have chosen GNP as the activity variable for the calculations. But some authors used industrial production as a proxy for economic activity. Similarly, some authors used price variables that differ from ours. Thus, the coefficient estimates that we use sometimes come from quite different specifications.

- Even when authors employ similar specifications, a wide range of coefficient estimates can arise from differences in data sets and estimation techniques.

- The calculations are quite sensitive to the values of the selected coefficients. For example, increasing the responsiveness of trade flows to relative prices has a major impact on the imputed effect of dollar appreciation. Likewise, altering the activity level elasticities gives differing estimates of the influence of the business cycle on the trade balance.

- The prototype equations are largely recursive and thus do not fully capture the joint determination of exchange rates and trade volumes and prices.

For all these reasons, it is important not to overemphasize any particular calculation based on a specific set of point estimates but to interpret these calculations as indicative of reasonable ranges of the relative strength of effects on U.S. trade that can be imputed to various sources.

The Calculations

The calculations are based on a limited set of basic economic data summarized in Table 2.

The prototype equations employed a range of coefficient estimates distilled from the literature survey. For each set of coefficients a series of calculations was performed.

1. Influence of the strong dollar. Since the middle of 1980, the dollar has appreciated by approximately 30 percent more than can be accounted for on the basis of differences in nations' inflation rates. 1/ To measure the effect of the dollar appreciation on U.S. trade performance, calculations were performed to determine what the U.S. trade balance would have been if the dollar had moved in line with relative rates of inflation here and abroad (while allowing foreign and domestic activity to track their actual paths in 1980-1983). The difference between the actual U.S. trade deficit and the smaller, hypothetical, deficit that would have occurred if the dollar had not appreciated in real terms was imputed to the exchange rate change.

2. Influence of foreign economic activity. During the 1970s, our major trading partners' economies grew at an average annual rate of 3 percent while their economies displayed almost no real growth in the period

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1/ The size of the dollar's appreciation relative to differences in nations' inflation rates can vary substantially depending both on the nominal exhange rate index that is chosen and on the price indexes that are used for national cost comparisons.

TABLE 2
(Data sources listed in Appendix)

	Nominal Dollar Exchange Rate Index (R)	U.S. Consumer Price Index (PC)	Foreign Consumer Price Index (PF)	U.S. Export Deflator (PX)	U.S. Import Deflator (PM)	Price of U.S. Exports (XRP)	Relative Price of Imports (MRP)	U.S. GNP (billions of 1972 dollars) (Y)	Foreign GNP (constant dollar) (YF)	Merchandise Trade Balance a/
1980:3	85.4	1.8	2.3	2.5	3.3	89.9	184.4	1464.2	136.3	-15.8
1980:4	89.0	1.9	2.4	2.6	3.5	96.0	186.2	1477.9	136.8	-20.8
1981:1	94.5	1.9	2.5	2.6	3.5	101.6	187.1	1510.1	137.0	-17.9
1981:2	103.1	1.9	2.5	2.7	3.5	109.1	181.0	1512.5	137.1	-29.4
1981:3	110.0	2.0	2.6	2.7	3.3	115.1	169.8	1525.8	137.5	-33.6
1981:4	105.4	2.0	2.6	2.7	3.2	108.7	162.5	1506.9	137.9	-31.4
1982:1	109.9	2.0	2.7	2.7	3.3	113.1	163.0	1485.8	137.5	-24.4
1982:2	114.0	2.0	2.7	2.7	3.2	113.1	154.7	1489.3	137.7	-23.4
1982:3	119.8	2.1	2.8	2.7	3.2	116.2	156.2	1485.7	137.1	-52.3
1982:4	122.2	2.1	2.8	2.7	3.2	116.5	152.4	1480.7	137.3	-45.4
1983:1	119.4	2.1	2.8	2.7	2.9	114.2	140.2	1490.1	138.1	-32.3
1983:2	123.0	2.1	2.9	2.7	3.0	115.7	141.2	1525.1	138.6	-58.6
1983:3	128.7	2.1	2.9	2.7	3.1	120.3	144.8	1553.4	138.4	-72.7
1983:4	130.2	2.2	3.0	2.8	3.0	122.2	140.3	1571.9	140.3	-83.1

a/ Billions of current dollars.

NOTE: For PC, PF, PX, PM: 1972=1.0
For R: 1973=100
For YF: 1970 = 100

from 1980 to 1983. A calculation was performed to determine what the U.S. trade balance would have been in the 1980-1983 period if foreign economies had grown at 3 percent per year, while allowing the value of the dollar and U.S. economic activity to track their actual values. The difference between the observed U.S. trade deficit and the smaller deficit that would have occurred if foreign economies had grown at 3 percent per year was imputed to slow foreign economic activity.

3. The influence of U.S. economic activity. In the period under consideration, the United States experienced a deep recession followed by strong recovery. During the recession, the demand for imports fell below levels that would have occurred if the U.S. economy had grown at a historical trend rate of 3 percent. Conversely, during the recovery, the demand for imports surged ahead of levels that would be associated with trend growth.

To measure the effects of the business cycle on U.S. trade performance, a calculation was made to determine what the U.S. trade deficit would have been if the U.S. economy had grown at a steady 3 percent trend rate. The difference between the actual and calculated trade deficits was used to measure the impact of the U.S. business cycle.

4. Influence of the LDC debt crisis. The decline in LDC demand for U.S. exports has been far greater than can be explained solely on the basis of the decline in levels of economic LDC activity. Calculations have been performed to determine the extent of the actual decline in U.S. exports to

LDCs that can be related to their recessions, with the remainder being attributed to "extraordinary credit constraints." Because the foreign activity variable is designed to capture the influence of LDC recession on the demand for U.S. exports, it is only the portion of the export decline not attributable to LDC recession that has been treated as an exogenous adjustment representing the impact of "extraordinary credit constraints."

5. Combined influence of foreign economic activity, LDC debt crisis, the strong dollar, and the U.S. business cycle. To measure the joint influence of the four factors, the trade deficit was calculated as it would have been if the U.S. and foreign economies had grown at 3 percent trends, the dollar had not become overvalued on a relative cost basis, and credit constraints had not affected LDC demand for U.S. exports. The difference between the actual and the calculated deficit was imputed to be the combined effect of all four factors.

Results of Calculations

The accompanying table presents the results of calculations employing three alternative sets of coefficient estimates. Before turning to the effects originating from each source, several general points can be noted. First, only when coefficient estimates from the low end of the survey range are employed do the prototype equations not overaccount for the observed deterioration in the merchandise trade balance. Second, the appreciation of the dollar plays the major role in accounting for the decline in the trade

SOURCES AND SHARES OF THE DECLINE IN THE U.S. MERCHANDISE TRADE BALANCE UNDER ALTERNATIVE COEFFICIENT ESTIMATES

	Deterioration Originating in Sources (1980:3 to 1983:4, Annual Rates)					
	Model 1 (Low-end Coefficients)		Model 2 (Low-range Coefficients)		Model 3 (Mid-range Coefficients)	
	Billions of Current $	Share of Explained Deterioration	Billions of Current $	Share of Explained Deterioration	Billions of Current $	Share of Explained Deterioration
(1) Dollar Appreciation	38 deterioration	61 percent	50 deterioration	65 percent	84 deterioration	69 percent
(2) Weak Foreign Economic Activity	14 deterioration	22 percent	15 deterioration	19 percent	24 deterioration	20 percent
(3) U.S. Economic Activity	17 improvement	-26 percent	20 improvement	-25 percent	27 improvement	-23 percent
(4) LDC Debt Crisis	22 deterioration	35 percent	22 deterioration	29 percent	22 deterioration	18 percent
(5) Interaction of the Four Sources	5 deterioration	8 percent	9 deterioration	12 percent	19 deterioration	15 percent
(6) Four Sources Together	62 deterioration	100 percent	76 deterioration	100 percent	122 deterioration	100 percent
(7) Actual Deterioration	67 deterioration	--	67 deterioration	--	67 deterioration	--
(8) Percent of Actual Deterioration Accounted for by the Four Sources Together	92.5 percent	--	113 percent	--	182 percent	--

balance--no matter which coefficient estimates are employed. Third, over the period from 1980:3 to 1983:4, if the economy had grown at trend, then the trade deficit would have been greater than it actually was. This means that from mid-1980 through the end of 1983, the dampening effect on imports caused by recession outweighed the stimulative effect of the first four quarters of recovery. Of course, if the horizon were extended to include more quarters of expansion, then the reported effect of U.S. economic activity could be reversed. Finally, and related to the previous point, the shares of the explained deterioration originating in each source depend on the period under consideration. For example, if the horizon were 1982:4 to 1984:1, U.S. economic activity would undoubtedly contribute to the deterioration of the U.S. trade deficit and the shares of other factors could be quite different.

1. Exchange rate. The calculations reveal that the overvalued dollar has had a major impact on U.S. trade performance. While the size of the effect is quite sensitive to the values of the assumed coefficients, calculations performed under alternative parameter assumptions allow us to conclude that the strong dollar has played the major role in the deterioration of the U.S. merchandise trade balance. Specifically, when calculations are performed using import and export price elasticities in the mid-range of estimates found in the literature, the appreciation of the dollar by itself overaccounts for the observed deterioration in the U.S. merchandise trade balance.

Even when the calculations are performed using import and export price elasticities from the low portion of the survey range (which lessens the impact of dollar appreciation on trade flows) and using price passthrough assumptions that tend to weaken the impact of dollar appreciation, the prototype equations still yield a major impact of dollar appreciation on trade flows. Based on the Model 2 parameter assumptions, the appreciation of the dollar had led by the end of 1983 to approximately a $50 billion deterioration (annual rate) in the merchandise trade balance.

2. Foreign economic activity. The calculations reveal that the slow pace of foreign economic activity has made a substantial contribution to the decline in U.S. export performance. The key parameter that determines the size of the impact is the foreign income elasticity of demand for imports. Depending on whether one employs parameter estimates from the high or low end of the survey range, the imputed influence of foreign economic activity can vary by as much as $20 billion.

Employing an estimate of the foreign income elasticity of demand from the low end of the range (which diminishes the effect on U.S. trade balances of slow foreign economic activity), the prototype equations yield a deterioration of approximately $15 billion (annual rate) from this source.

3. U.S. economic activity. The key parameter that determines the size of the impact of the U.S. business cycle on U.S. trade performance is the U.S. income elasticity of demand for imports. The surveyed estimates of this parameter showed much less diversity than those for other

coefficients, with several estimates clustering around a value of 1.8. Employing this value, our calculations revealed:

- During the six quarters of the recession (1981:3-1982:4), U.S. imports were approximately $15 billion less than they would have been if the United States had grown at trend.
- In the first four quarters of the recovery, U.S. imports were approximately $5 billion greater than they would have been if the United States had grown at trend.

4. LDC credit constraints. In 1983, U.S. exports to LDCs were approximately $28 billion below what they would have been if U.S. exports to LDCs had grown at the trend rate of the 1970s. Of this $28 billion shortfall, approximately $6 billion can be attributed to the effects of the recession in LDCs. The remaining $22 billion shortfall has been imputed to "extraordinary credit constraints."

5. Combined impact of the four factors. Applying coefficient estimates from Model 1, the calculations indicate that from the second quarter of 1980 (when the dollar began its ascent) to the end of 1983, the four factors together implied a deterioration in the U.S. merchandise trade balance of approximately $62 billion (annual rate). Over this period, the actual deterioration in the U.S. merchandise trade balance was $67 billion at an annual rate. Thus, the four factors account for 92 percent of the observed deterioration.

When Model 2 coefficient assumptions are employed, the four sources together account for 113 percent of the observed deterioration. The variability that emerges as alternative coefficient estimates are employed

should caution against overemphasizing the results of any particular calculation. Rather, the results are indicative of the relative contribution of the four sources which have been most important for U.S. trade performance.

APPENDIX

PROTOTYPE SPECIFICATION

Exports:

(1) Export Volume Equation

$$\ln X = a_1 \ln YF + a_2 \ln XRP$$

(2) Export Price Equation

$$\ln PX = b_1 \ln PC_{-1} + b_2 \ln PF + b_3 \ln R$$

Imports:

(3) Import Volume Equation

$$\ln M = c_1 \ln Y + c_2 \ln MRP$$

(4) Import Price Equation

$$\ln PM = d_1 \ln PC_{-1} + d_2 \ln PF + d_3 \ln R$$

MODEL 1
(LOW-END ESTIMATES)

(1) $\ln X = 0.9 \ln YF - 0.9 \ln XRP$

(2) $\ln PX = 0.9 \ln PC + 0.15 \ln PF - 0.15 \ln R$

(3) $\ln M = 1.8 \ln Y - 0.8 \ln MRP$

(4) $\ln PM = 0.2 \ln PC + 0.8 \ln PF - 0.8 \ln R$

Note: The price variables XRP, MRP, and R (in equation (4)) are assumed to operate over eight periods with the cumulative effect apportioned as follows:

t	t-1	t-2	t-3	t-4	t-5	t-6	t-7
22%	19%	16%	13%	10%	8%	7%	5%

The price variable PF is assumed to operate over four periods with the cumulative effect apportioned as follows:

t	t-1	t-2	t-3
40%	30%	20%	10%

The income variables Y and YF are assumed to operate over two periods apportioned as follows:

t	t-1
55%	45%

Results: Actual deterioration = $67 billion (1980:3 to 1983:4, annual rate)

Impact of the four factors taken separately (1980:3 to 1983:4, annual rate)

Strong dollar	$38 billion deterioration
Weak foreign economic activity	$14 billion deterioration
U.S. business cycle	$17 billion improvement
LDC debt crisis	$22 billion deterioration

Impact of the four factors together (1980:3 to 1983:4, annual rate)

$62 billion deterioration

MODEL 2
(LOW-RANGE COEFFICIENTS)

(1) $\ln X = 1.0 \ln YF - 0.75 \ln XRP$

(2) $\ln PX = 0.7 \ln PC_{-1} + 0.6 \ln PF - 0.6 \ln R$

(3) $\ln M = 1.8 \ln Y - 1.0 \ln MRP$

(4) $\ln PM = 0.25 \ln PC_{-1} + 0.8 PF - 0.8 \ln R$

Note: The price variables XRP, PF, R, and MRP are assumed to operate over eight periods. We assume a lag structure which apportions the cumulative effect as follows.

t	t-1	t-2	t-3	t-4	t-5	t-6	t-7
22%	19%	16%	13%	10%	8%	7%	5%

The income variables YF and Y are assumed to operate over four periods with the cumulative effect apportioned as follows:

t	t-1	t-2	t-3
40%	30%	20%	10%

Results: Actual deterioration = $67 billion (1980:3 to 1983:4, annual rate)

Impact of the four factors taken separately (1980:3 to 1983:4, annual rate)

Strong dollar	$50 billion deterioration
Weak foreign economic activity	$15 billion deterioration
U.S. business cycle	$20 billion improvement
LDC debt crisis	$22 billion deterioration

Impact of the four factors together (1980:3 to 1983:4, annual rate)

$76 billion deterioration

MODEL 3
(MID-RANGE COEFFICIENTS)

(1) $\ln X = 1.5 \ln YF - 1.3 \ln XRP$

(2) $\ln PX = 0.5 \ln PC_{-1} + 0.5 \ln PF - 0.45 \ln R$

(3) $\ln M = 2.37 \ln Y - 1.4 \ln MRP$

(4) $\ln PM = 0.4 \ln PC_{-1} + 0.8 \ln PF - 0.75 \ln R$

Note: The price variables XRP, PF, R, and MRP are assumed to operate over eight periods. We assume a lag structure which apportions the cumulative effect as follows.

t	t-1	t-2	t-3	t-4	t-5	t-6	t-7
22%	19%	16%	13%	10%	8%	7%	5%

The income variables YF and Y are assumed to operate over four periods with the cumulative effect apportioned as follows:

t	t-1	t-2	t-3
40%	30%	20%	10%

Results: Actual deterioration = $67 billion (1980:3 to 1983:4, annual rate)

Impact of the four factors taken separately (1980:3 to 1983:4, annual rate)

Strong dollar	$84 billion deterioration
Weak foreign economic activity	$24 billion deterioration
U.S. business cycle	$27 billion improvement
LDC debt crisis	$22 billion deterioration

Impact of the four factors taken together (1980:3 to 1983:4, annual rate)

$122 billion deterioration

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DEFINITION OF VARIABLES

X	Real exports, merchandise. Balance of Payments Basis.
YF	Real foreign economic activity. Weighted foreign real GNP (source: Federal Reserve Board).
XRP	Relative price of U.S. exports, exchange-rate adjusted. Ratio of merchandise export price deflator to weighted foreign CPI times the dollar exchange rate (source: Federal Reserve Board).
PX	Export price deflator, merchandise.
PC	Domestic consumption deflator.
PF	Foreign price index. Weighted foreign CPI (source: Federal Reserve Board).
R	Trade-weighted dollar exchange rate index (source: Federal Reserve Board).
M	Real imports, merchandise. Balance of Payments Basis.
Y	Real domestic economic activity. Real US GNP.
MRP	Relative price of U.S. imports, exchange-rate adjusted. Ratio of import price deflator to domestic consumption deflator.
PM	Import price deflator, merchandise.