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A Model of the U.S. Current Account

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Abstract

This paper presents an econometric model of U.S. current account transactions. The model is used to analyze the factors behind the deterioration in the U.S. external position during the 1980s and to examine the sensitivity of the U.S. current account balance to changes in factors which are its major determinants. The results suggest that the appreciation of the U.S. dollar and relatively faster economic growth in the United States account for most of the rise in the U.S. external deficit. The results also indicate that the depreciation of the dollar since March 1985 has contributed to a substantial improvement in the U.S. current account balance relative to what it otherwise might have been.

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Summary

Within a relatively short span of time during the 1980s, the U.S. current account balance shifted from a small surplus to deficits of unprecedented magnitudes. This paper presents an econometric model of U.S. current account transactions. The model is used to analyze the major factors contributing to the deterioration of the U.S. external position and to examine the sensitivity of the U.S. current account balance to changes in its major determinants.

Results from the model's analysis of sources of changes in the U.S. trade balance suggest that roughly two thirds of the $87 billion increase in the merchandise trade deficit during 1981-84 reflected changes in the price competitiveness of U.S. producers and changes in the terms of trade, both of which were related to the rise in the value of the dollar. The remaining portion is largely explained by faster economic growth in the United States relative to other countries. A further deterioration in the trade balance of $32 billion in 1985-86 was largely attributable to relatively stronger U.S. economic growth. Declining price competitiveness, reflecting the lagged impact of the dollar's previous appreciation, was a negative factor in 1985; however, the competitive position of U.S. producers improved in 1986, limiting the rise in the deficit.

An analysis of the sensitivity of the current account model to changes in some of its key exogenous determinants indicates that, in response to a real exchange rate change, improvement in the current account balance largely stems from an improvement in the trade balance. Over time, however, a larger share of the change in the current account is accounted for by an improvement in the services balance, as a less rapid buildup of external debt results in lower portfolio investment income payments. Alternative exchange rate scenarios are used to illustrate the importance of the magnitude and timing of changes in exogenous determinants on the path of the current account balance, largely owing to their influence on the accumulation of foreign debt. The results also suggest that a reduction in the level of U.S. economic activity would produce a somewhat larger improvement in the U.S. current account than a similar increase in the level of activity in the rest of the world.

Finally, the model is used to illustrate the possible impact on the U.S. current account deficit of the real depreciation of the dollar since early 1985. The results suggest that the decline in the real value of the dollar contributed to a significant improvement in the current account balance, on the order of $10 billion in 1985, $50 billion in 1986, and around $130 billion in 1987 relative to what it otherwise might have been.

I. Introduction

The U.S. current account balance shifted from a small surplus in 1980 to a deficit expected to exceed $160 billion in 1987. As the deficit widened, discussion focused on the relative importance of the various factors that contributed to the deterioration. At the same time, considerable debate was generated regarding the most effective means of correcting the situation. In essence, the discussion centered on questions regarding the sensitivity of U.S. current account transactions to changes in key economic variables such as economic activity in the United States and the rest of the world and real exchange rates.

In this paper an econometric model of the U.S. current account is used to analyze these questions and their implications. The second section of the paper discusses the structure of the econometric model. The third section assesses the relative importance of several key factors contributing to the deterioration in the U.S. external balance over the period. The fourth section examines the sensitivity of U.S. current account transactions, as suggested by the model, to changes in their major determinants. The fifth section looks at the response of the current account balance to the depreciation of the U.S. dollar since early 1985. Appendix I to the paper presents the behavioral equations and the key identities of the current account model. Appendix II describes the methodology used to quantify the impact of changes in key explanatory variables on U.S. trade flows.

II. The Current Account Model

The model of U.S. current account transactions developed in this paper includes sectors for merchandise trade and services. 1/ The model was structured so as to facilitate the analysis of the causes of changes in the trade and current account deficits. In addition, the the specifications of the model's equations were kept relatively simple and the number of exogenous explanatory variables used was limited in order to facilitate simulation of the model. It should be noted that the model provides only a partial equilibrium framework of analysis because it treats such variables as levels of economic activity, prices, interest rates, and exchange rates as exogenous. Therefore, the interactions and feedbacks among the exogenous variables in the model and their effects on U.S. international transactions are not captured.

The following sections discuss the trade and services sectors of the model. A description of the behavioral equations and key identities is presented in Appendix I.

1/ Unilateral transfers are treated as being exogenously determined.

1. The trade sector

The trade sector of the current account model consists of five equations for the volume of exports, two equations for the volume of imports, and three equations for trade prices (equations 1-12 in Appendix I). Separate equations were estimated for the volumes of agricultural and nonagricultural exports to industrial countries and non-oil developing countries, respectively. An equation was also estimated for the volume of total exports to members of OPEC. Exports to Eastern European countries are treated as exogenous. On the import side, equations were estimated for the volume of petroleum and nonpetroleum imports. Separate equations were estimated for the deflators for nonagricultural exports and nonpetroleum imports. The deflators for agricultural exports and petroleum imports are exogenous. An equation was also estimated for a weighted average of local currency export prices of other major industrial countries in order to capture the impact of exchange rate changes on the pricing behavior of U.S. competitors.

Export and import volumes were derived by using the relevant implicit price deflators for merchandise trade. Constant dollar estimates for agricultural and nonagricultural exports by country group were obtained by using the respective deflators for total exports in each commodity category. Equations for the volumes of exports and imports were generally specified as functions of an appropriate income variable and the price of domestically produced goods relative to the price of foreign produced competing products expressed in U.S. dollars. In the case of U.S. exports to developing countries, a balance of payments constraint was added to the equations.

The equations estimated differ from the general specification described above in some respects. The equations for agricultural exports do not include relative price terms. Agricultural commodities that are traded internationally tend to be rather homogeneous, are generally priced in U.S. dollars, and differentials between the prices set by different producers are very small. 1/ The exchange rate variable in the equation for agricultural exports to industrialized countries is included to capture the substitution effect arising from a change in the local currency price of agricultural goods stemming from a change in the value of the U.S. dollar and the change in relative competitiveness of non-U.S. producers. 2/ Also, no relative price variable was found to be significant in the equation for total exports to members of OPEC,

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1/ The farm policies adopted by the United States and other countries can also significantly affect relative costs and export supplies, influencing the volume of U.S. exports. Modeling such affects, however, is extremely difficult and is beyond the scope of the simple model presented here.

2/ A similar variable in the equation for U.S. agricultural exports to non-oil developing countries was not statistically significant.

suggesting that nonprice considerations may be more important in determining the sourcing of OPEC imports. The purchasing power variable in this equation 1/ tends to capture both the effects of changes in income and the balance of payments constraint on imports by these countries. Finally, estimates for the volume of petroleum imports are derived from an equation for U.S. oil consumption and exogenous estimates of U.S. petroleum production and changes in stocks. 2/

Table 1 shows estimates for income and price elasticities of merchandise trade volumes derived from the model. The estimates suggest a high degree of income elasticity for both exports and imports, with relatively small differences between the two sets of estimates. This result contrasts sharply with the findings of empirical studies in the 1960s and 1970s. 3/ These studies generally found import income elasticities to be roughly twice the size of those for exports. The narrowing of the difference between export and import income elasticities appears to reflect a rise in the income elasticity of exports over time. The results presented in Table 1 are in line with those of other recent studies. A survey of current account models by Bryant, Holtham, and Hooper [1988] indicates estimates of income elasticities in the range of 1 1/2 to 2 1/4 for total exports and 1 3/4 to 2 1/4 for total imports. 4/ The absolute value of the price elasticities for export and import volumes in the model are estimated to be around one, suggesting that a depreciation of the dollar would lead to an improvement in the trade balance and vice versa.

1/ Export revenues deflated by a weighted average of consumer prices for these countries.

2/ Changes in stocks include changes in the Strategic Petroleum Reserve. Additional adjustments are made to account for oil exports and for timing and definitional differences between the volume of petroleum imports derived as a residual from the consumption, production, stocks, and export data and the volume of imports in the balance of payments statistics.

3/ For a survey of empirical work done during this period, see Goldstein and Kahn [1985].

4/ Helkie and Hooper [1988] estimate income elasticities of 1.2 for agricultural exports, 2.1 for nonagricultural exports, roughly 2 for petroleum imports, and 2.4 for nonpetroleum imports.

Table 1. Estimated Long-Run Income and Price Elasticities of Merchandise Trade Volumes

	Elasticity With Respect To: Income	Price
U.S. Exports	1.9	-1.2
Agricultural	1.7	-0.6
To: Industrial countries	1.6	-1.0 1/
Non-oil developing countries	2.0	--
Nonagricultural	2.0	-1.3
To: Industrial countries	1.9	-1.3
Non-oil developing countries	2.3	-1.3
U.S. Imports	2.5	-1.0
Petroleum	2.0	-0.5
Nonpetroleum	2.7	-1.1
Memorandum:		
U.S. Exports to OPEC	0.6	--

1/ Impact of a change in the effective value of the U.S. dollar.

The equations for U.S. nonagricultural and foreign export prices (equations 10 and 12 in the appendix) specify these prices as functions of domestic costs, competitors' prices, and exchange rates. In the nonagricultural export price equation, an index of prices for computer equipment also was included as an explanatory variable because of the importance of such products in U.S. exports and the significant difference in the behavior of computer prices relative to the prices of other manufactured products. The equation for nonpetroleum import prices (equation 11 in Appendix I) is basically a bridge equation that reflects the translation of foreign export prices adjusted for exchange rates to U.S. import prices. The commodity price variable in this equation is designed to capture the difference in the behavior of commodity prices relative to the prices of other imported goods, particularly during the 1980s.

Both export price equations suggest that domestic costs are the primary determinant of export prices; however, the markup of export prices over domestic costs is significantly influenced by competitors' prices and exchange rates. In the case of foreign export prices, the influence of competitors' prices and exchange rates on markups is unwound over time.

2. The services sector

The services sector of the current account model consists of eight behavioral equations for major categories of services and two identities used to estimate portfolio income receipts and payments. Military transactions are treated as being exogenously determined. In this sector, separate equations were estimated for receipts and payments of travel and passenger fares, transportation, other services, 1/ and direct investment income. The specification of these equations is rather eclectic reflecting both the nature of the transactions involved and the way in which they are estimated in the U.S. balance of payments accounts.

The equations for receipts and payments on travel and passenger fare receipts and payments (equations 13 and 18 in Appendix I) relate the volume of such transactions to economic activity and relative prices adjusted for changes in exchange rates. Volumes for these transactions are derived by deflating receipts by the implicit price deflator for U.S. GNP and payments by a weighted average of foreign consumer prices adjusted for exchange rates. The equations suggest that the income elasticities of both travel and passenger fare receipts and payment are in the vicinity of 1 1/4. Travel and passenger fare payments, however, are more price elastic than receipts; the price elasticity was estimated to be 1 1/4 for payments and slightly less than 1 for receipts.

Estimates for transportation transactions in the U.S. balance of payments accounts are derived by multiplying average freight rates and average port expenditure costs by the volume of trade flows. The equations for transportation receipts and payments (equations 14 and 19 in Appendix I) are specified as functions of constant dollar exports and imports and price variables. In the equation for transportation receipts, changes in oil prices and in the U.S. implicit price deflator for GNP are used to proxy for changes in average freight rates and average port expenditure costs. In the transportation payments equation, the change in oil prices and the change in a weighted average of GNP implicit price deflators for other major industrial countries are used as proxies.

In estimating equations for receipts and payments for other services (equations 15 and 20 in Appendix I), it was found that a simple autoregressive process adequately explained these transactions. This specification implies that these services grow at a relatively steady rate over time.

1/ Other services include fees and royalties and miscellaneous services provided or purchased by U.S. private residents or the U.S. Government.

Direct investment income flows are specified in the model as being primarily determined by the profitability of these investments (equations 16 and 21 in Appendix I). Profitability was proxied by economic activity and prices. The effective value of the U.S. dollar was included in the equation for direct investment income receipts in order to capture the impact of the value of the dollar on the translation of income earned in foreign currency. The change in the effective exchange rate of the dollar was also included in order to capture the effect of changes in the dollar's value on the translation of the net asset position of foreign affiliates. 1/ In addition, oil prices were included in the equation because of the importance of U.S. direct investment abroad in the petroleum sector. A dummy variable equal to one in 1979 and zero in all other years was used to account for the completion of the takeover of a major U.S. petroleum affiliate which led to a surge in income receipts. Direct investment income payments were estimated simply as a function of nominal U.S. GNP.

The equations for portfolio receipts and payments (equations 17 and 22 in Appendix I) are simplified versions of the identities used in the U.S. balance of payments accounts to calculate these income flows. They specify receipts (payments) as being equal to an average yield times the gross stock of assets (liabilities) held by private residents. In simulating the model, the identity for portfolio income payments plays a key role because the stock of U.S. portfolio liabilities is determined endogenously. Assumptions are made for net direct investment flows, U.S. private portfolio capital flows, net official flows, and the statistical discrepancy. Using the balance of payments identity, the change in portfolio liabilities is set equal to the sum (with sign reversed) of the estimated current account balance and the exogenous components of the capital account. In this manner, the model captures the important influence on portfolio interest payments of an accumulation of foreign debt stemming from U.S. current account deficits.

III. Sources of Changes in the U.S. External Balance

The U.S. current account shifted from a surplus of $2 billion in 1980 to a deficit of $141 billion in 1986. Over this period the merchandise trade deficit widened from $25 billion to $144 billion. Often cited as factors contributing to this deterioration in the current account and trade balances are the relatively strong economic performance of the United States during this period; a loss in price competitiveness by U.S. producers stemming from the appreciation of the dollar

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1/ In the U.S. balance of payments accounts, an "all inclusive" concept of income is used. Income is defined as earnings plus realized and unrealized capital gains. Unrealized capital gains reflect the change in the valuation of the net asset position of foreign affiliates in U.S. dollars. Such gains largely stem from changes in the value of the dollar.

from mid-1980 to early 1985; a decline in U.S. exports to developing countries, reflecting the debt problems of some of these countries (particularly in Latin America); and a drop in earnings of oil-exporting countries. 1/ The relative contribution of these factors to the rise in the U.S. external imbalance was analyzed using the current account model described in the previous section. The analysis in this section is limited to trade flows because of difficulties in attributing changes in some service transactions (particularly portfolio investment income payments) to the types of factors mentioned above. 2/

1. Sources of changes in U.S. exports

Estimates of the effects on U.S. exports of changes in explanatory variables by commodity and by area are presented in Tables 2 and 3, respectively. During the period 1981-84, when the dollar was appreciating, the value of U.S. exports declined by $4 1/2 billion. This decline reflected the effects of a substantial loss in the price of competitiveness of U.S. producers resulting from the real appreciation of the dollar, an increasing debt burden of non-oil developing countries, and declining export earnings of oil-exporting countries (see Table 2). These effects were partly offset by rising economic activity in the rest of the world over the period and an increase in U.S. export prices. In 1985-86 when the dollar was generally depreciating, the value of U.S. exports increased by $4 1/2 billion, with a strong rise in nonagricultural exports being largely offset by a steep drop in agricultural exports. Declines in export prices and continuing adverse effects of the drop in oil-exporting countries' earnings and the debt burden of non-oil developing countries served to restrain growth in the value of U.S. exports, but these factors were offset by the effects of economic growth abroad and a substantial improvement in competitiveness.

By area, the drop in the value of U.S. exports during the period 1981-84 was more than accounted for by the developing countries (see Table 3). The decline in U.S. exports to these countries largely reflected the influence of the loss in export earnings of oil-exporting countries and the rising debt burden of other developing countries. The value of U.S. exports to industrial countries rose modestly during this period, as the loss in price competitiveness offset most of the effects stemming from other factors. In 1985-86, the value of U.S. exports to industrial countries rose, more than offsetting further declines in

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1/ These factors can be viewed as proximate causes of the deterioration in the U.S. external balance. Of course, these proximate causes were, in turn, related to more fundamental developments regarding macroeconomic policies in the United States and other countries. However, analysis of the role played by such developments is beyond the scope of this paper.

2/ Appendix II provides a description of the methodology used to quantify the impact of changes in key explanatory variables on trade flows.

exports to developing countries. A drop in export prices diminished to some extent the favorable impact of improved competitiveness and economic growth on the value of exports to industrial countries. In the case of developing countries, the decline in the value of exports reflected the continuing adverse effects of the debt burden of these countries and a decline in export earnings of OPEC members, as well as the drop in U.S. export prices.

2. Sources of changes in U.S. imports

During 1981-84, the value of U.S. imports rose by $83 billion; a sharp rise in nonpetroleum imports was offset in part by a decline in petroleum imports (see Table 4). The surge in nonpetroleum imports over this period was attributable in approximately equal parts to the impact of strong economic growth in the United States and to the loss in price competitiveness of U.S. producers due to the dollar's appreciation. Petroleum imports declined owing to the effect on volume of a sharp rise in the relative price of oil in the early part of the period and to the drop in oil prices in the latter part. In addition, there was a sizable rundown in petroleum stocks over the period. In 1985-86, a rise in nonpetroleum imports more than offset a further drop in petroleum imports. The continued expansion of economic activity in the United States and the lagged adjustment of import volumes to the decline in the dollar's value were major factors explaining the rise in nonpetroleum imports. The decline in petroleum imports reflected a drop in oil prices.

3. Sources of changes in the U.S. trade balance

Table 5 shows the net impact of developments in 1981-86 on the U.S. merchandise trade balance. The table indicates that in the period 1981-84 the appreciation of the dollar and the relative cyclical position of the United States were the major factors explaining the deterioration in the trade balance. Changes in price competitiveness and in the terms of trade--both of which mainly reflected the rise in the value of the dollar--together contributed some $60 billion to the deterioration in the trade balance. Faster economic growth in the United States relative to other countries contributed some $28 billion to the rise in the trade deficit. The debt problems of some non-oil developing countries and declines in the revenues of oil-exporting countries also played significant, albeit smaller, roles in explaining the widening of the trade deficit.

The further deterioration of the trade balance in 1985-86 was largely attributable to relatively stronger U.S. economic growth. The debt burden of non-oil developing countries and declining oil revenues of exporting countries also continued to contribute to the widening of the deficit. Declining price competitiveness, reflecting the lagged impact of the dollar's appreciation in 1980-84, was a negative factor in 1985. However, the competitive position of U.S. producers improved in 1986, helping to limit the rise in the trade deficit.

Table 2. Sources of Changes in U.S. Exports

(In billions of dollars)

Year	Actual Change	Effects of Changes in: Economic Activity	OPEC Purchasing Power	Debt Burden 1/	Competitiveness 2/	Export Prices 3/	Residual 4/
				Total Exports			
1981	12.8	9.2	2.7	-5.3	-5.9	16.1	-3.9
1982	-25.9	0.7	-3.1	-9.8	-20.8	--	7.1
1983	-9.4	7.6	-4.4	-2.3	-9.6	-1.5	0.8
1984	18.1	16.4	-3.4	1.5	-4.3	3.0	4.9
1985	-4.0	15.1	-1.9	-4.1	-3.7	-10.6	1.3
1986	8.4	12.1	-1.4	-1.1	17.7	-8.4	-10.4
1981-84	-4.4	33.9	-8.2	-15.9	-40.6	17.6	8.9
1985-86	4.4	27.2	-3.3	-5.2	14.0	-19.0	-9.1
				Agricultural Exports			
1981	1.9	1.5	0.4	-1.7	-2.6	2.0	2.3
1982	-6.8	0.2	-0.5	-3.1	-2.4	-4.5	3.5
1983	-0.1	1.1	-0.6	-0.7	-1.1	1.4	-0.3
1984	1.3	2.5	-0.6	0.5	-1.5	1.5	1.2
1985	-8.8	2.1	-0.4	-1.2	-0.8	-3.3	-5.1
1986	-2.5	1.3	-0.3	-0.3	3.0	-2.1	-4.1
1981-84	-3.7	5.3	-1.3	-5.0	-7.6	0.4	6.7
1985-86	-11.3	3.4	-0.7	-1.5	2.2	-5.4	-9.2
				Nonagricultural Exports			
1981	10.9	7.7	2.3	-3.6	-3.4	14.1	-6.2
1982	-19.1	0.5	-2.6	-6.8	-18.4	4.5	3.6
1983	-9.3	6.5	-3.9	-1.6	-8.5	-2.9	1.1
1984	16.8	13.9	-2.8	1.0	-2.8	1.5	6.0
1985	4.9	13.0	-1.5	-2.9	-2.9	-7.3	6.4
1986	11.0	10.8	-1.1	-0.9	14.7	-6.3	-6.2
1981-84	-0.7	28.6	-7.0	-11.0	-33.1	17.2	4.5
1985-86	15.9	23.8	-2.6	-3.8	11.8	-13.6	0.2

1/ Effect on volume, measured at current prices.
2/ Effect on the volume of exports of lagged changes in relative export prices adjusted for exchange rates, measured at current prices
3/ Effect on the value of exports of changes in U.S. export prices.
4/ Includes exports to Eastern Europe and the unexplained residual.

Table 3. Sources of Changes in U.S. Exports by Country Group

(In billions of dollars)

Year	Actual Change	Effects of Changes in: Economic Activity	OPEC Purchasing Power	Debt Burden 1/	Competitiveness 2/	Export Prices 3/	Residual 4/
			Industrial Countries				
1981	4.8	5.0	...	...	-7.8	9.9	-2.3
1982	-14.7	-1.8	...	...	-14.5	0.2	1.4
1983	1.1	5.7	...	...	-5.7	-1.1	2.2
1984	12.6	10.3	...	...	-4.0	1.8	4.5
1985	-2.0	9.0	...	...	-1.9	-6.7	-2.4
1986	9.4	7.5	...	...	16.8	-5.6	-9.4
1981-84	3.8	19.2	...	...	-32.0	10.8	5.8
1985-86	7.4	16.5	...	...	14.9	-12.3	-11.8
			OPEC Members				
1981	3.7	...	2.7	...	...	1.5	-0.4
1982	-0.4	...	-3.1	...	...	0.1	2.5
1983	-5.4	...	-4.4	...	...	-0.1	-0.9
1984	-1.5	...	-3.4	...	...	0.2	1.7
1985	-2.4	...	-1.9	...	...	-0.6	0.2
1986	-0.9	...	-1.4	...	...	-0.4	0.9
1981-84	-3.6	...	-8.2	...	...	1.7	2.9
1985-86	-3.3	...	-3.3	...	...	-1.0	1.1
			Non-Oil Developing Countries				
1981	4.0	4.2	...	-5.3	1.9	4.7	-1.6
1982	-10.1	2.5	...	-9.8	-6.3	-0.3	3.9
1983	-4.3	1.9	...	-2.3	-3.9	-0.2	0.2
1984	5.6	6.1	...	1.5	-0.3	0.9	-2.6
1985	-0.3	6.1	...	-4.1	-1.8	-3.2	2.8
1986	0.2	4.6	...	-1.1	0.8	-2.4	-1.6
1981-84	-4.8	14.7	...	-15.9	-8.6	5.1	-0.1
1985-86	-0.1	10.7	...	-5.2	-1.0	-5.6	1.2

1/ Effect on volume, measured at current prices.
2/ Effect on the volume of exports of lagged changes in relative export prices adjusted for exchange rates, measured at current prices
3/ Effect on the value of exports of changes in U.S. export prices.
4/ Represents the portion of the change in exports that is not explained.

Table 4. Sources of Changes in U.S. Imports

(In billions of dollars)

Year	Actual Change	Effects of Changes in: Economic Activity 1/	Competitiveness 2/	Relative Price of Oil	Import Prices 3/	Residual 4/
			Total Imports			
1981	15.5	12.0	2.8	-6.0	13.3	-6.6
1982	-17.4	-17.6	14.7	-3.8	-7.7	-3.0
1983	21.2	23.1	14.4	-1.0	-10.8	-4.4
1984	63.5	44.7	13.1	0.2	-2.8	8.4
1985	5.7	29.3	16.4	1.3	-13.2	-28.2
1986	30.6	26.3	8.6	5.7	-17.0	7.0
1981-84	82.8	62.2	45.0	-10.6	-8.0	-5.6
1985-86	36.3	55.6	25.0	7.0	-30.2	-21.2
			Petroleum Imports			
1981	-1.6	3.3	...	-6.0	8.1	-7.0
1982	-16.5	-4.7	...	-3.7	-5.4	-2.7
1983	-6.3	5.6	...	-1.0	-5.5	-5.3
1984	2.3	8.9	...	0.2	-0.6	-6.2
1985	-6.9	4.9	...	1.3	-3.4	-9.7
1986	-16.6	4.0	...	-5.7	-26.7	0.4
1981-84	-22.1	13.1	...	-10.6	-3.4	-21.2
1985-86	-23.5	8.9	...	7.0	-30.1	-9.3
			Nonpetroleum Imports			
1981	17.1	8.7	2.8	...	5.2	0.5
1982	-0.9	-13.0	14.7	...	-2.3	-0.3
1983	27.5	17.5	14.4	...	-5.3	0.7
1984	61.2	35.7	13.1	...	-2.3	14.6
1985	12.6	24.4	16.4	...	-9.8	-18.4
1986	47.2	22.3	8.6	...	9.7	6.6
1981-84	104.9	48.9	45.0	...	-4.7	15.5
1985-86	59.8	46.7	25.0	...	-0.1	-11.8

1/ Effect on volume, measured at current prices.
2/ Effect on the volume of imports of lagged changes in relative prices adjusted for exchange rates, measured at current prices
3/ Effect on the value of imports of changes in U.S. import prices.
4/ Represents the portion of the change in imports that is not explained. The residual for petroleum imports (and total imports) also includes the effects of changes in domestic petroleum production and stocks.

Table 5. Sources of Changes in the U.S. Trade Balance

(In billions of dollars)

	1981	1982	1983	1984	1985	1986	1981-1984	1985-1986
Total change in the trade balance	-2.7	-8.5	-30.6	-45.4	-9.6	-22.2	-87.2	-31.8
Effects of changes in:								
Economic activity 1/	-2.8	18.4	-15.5	-28.3	-14.2	-14.2	-28.2	-28.4
Purchasing power of oil-exporting countries 2/	2.7	-3.1	-4.4	-3.4	-1.9	-1.4	-8.2	-3.3
Competitiveness 3/	-8.7	-35.5	-24.0	-17.4	-20.2	9.0	-85.6	-11.2
Relative price of oil 4/	6.0	3.8	1.0	-0.2	-1.3	-5.7	10.6	-7.0
Terms of trade 5/	2.8	7.7	9.4	5.8	2.6	8.6	25.7	11.2
Debt burden of non-oil developing countries 6/	-5.3	-9.8	-2.3	1.5	-4.1	-1.1	-15.9	-5.2
Other factors	2.7	10.1	5.2	-3.5	29.4	-17.4	14.5	12.0

1/ Net effects of changes in U.S. real GNP on the volume of imports and changes in real foreign economic activity on the volume of U.S. exports, valued at current prices.

2/ Effects on the volume of U.S. exports of changes in the constant dollar export revenues of oil-exporting countries, valued at current prices.

3/ Net effects of changes in relative prices adjusted for exchange rates on the volume of exports and imports, valued at current prices.

4/ Effects on the volume of U.S. oil imports of changes in the relative price of oil, valued at current prices.

5/ Net effects on the value of exports and imports of changes in export and import prices.

6/ Effects on the volume of U.S. exports of changes in the ratio of external debt to exports of goods and services for non-oil developing countries, valued at current prices.

4. Implications for the evolution of the U.S. external position

It has been noted that at the end of 1987 the real effective value of the dollar was roughly the same as in 1980 when the U.S. trade deficit was small relative to its present level and the current account was slightly in surplus. Improvement in the price competitiveness of U.S. producers appears to have continued to work in 1987 to reduce the trade deficit, and in the period ahead the effects of the dollar's depreciation since early 1985 that are still in the pipeline will yield further improvement. Nevertheless, the reduction in the trade deficit that is in prospect assuming constant real exchange rates is unlikely to bring the external balance back to a level comparable to that registered in 1980.

In part, this situation reflects the substantial gap that has opened up between levels of economic activity in the United States and in the rest of the world. According to Table 5, relatively faster U.S. economic growth contributed roughly $50 billion to the deterioration in the trade balance in 1981-86 and probably an additional amount in 1987. To unwind the influence of this factor on the external imbalance would require either relatively faster economic growth abroad or a further improvement in the competitive position of U.S. producers.

The shift in the net international investment position of the United States resulting from the deterioration in the current account balance since 1980 also has important implications for the evolution of the U.S. external imbalance over the medium term. The United States shifted from being a substantial net international creditor to being a net debtor in 1985, and subsequently the U.S. external debt has grown rapidly. As a result, portfolio investment income payments have risen sharply in the past few years and probably will continue to do so over the next several years. Thus, improvement in other components of the current account will be needed in order to maintain or reduce the deficit.

IV. The Sensitivity of the Current Account to Changes in Exogenous Variables

The sensitivity of the current account model to changes in some of its key exogenous determinants is illustrated in Table 6. The table shows changes in major components of the current account from a baseline path resulting from alternative assumptions regarding the real effective value of the dollar and the rate of growth of economic activity in the United States and the rest of the world. The baseline was constructed

by assuming a constant real effective value for the dollar 1/ and constant rates of growth (or levels as appropriate) for other exogenous variables. The baseline uses as its starting point estimates for current account transactions in 1987. Thus the magnitude of the effect of a change in a particular exogenous variable, measured in billions of dollars, will be dependent on these starting values. The simulations reflect the impacts of one-shot changes in the exogenous variables that are assumed to take place in the first year.

A note of caution needs to be raised regarding the interpretation of the results discussed below and presented in Table 6. As noted at the outset, the model presented in this paper is a partial equilibrium model. It treats levels of economic activity, prices, interest rates, and exchange rates as exogenous variables. An important implication of this limitation is that the model cannot deal with a variety of feedbacks and interactions. For example, in a general equilibrium multicountry model, a rise in U.S. imports stemming from higher GNP in the United States would lead to an increase in GNP abroad which, in turn, would lead to higher U.S. exports. This secondary effect on the U.S. current account is absent in a partial equilibrium model because the level of GNP abroad is treated as an exogenous variable.

Another aspect of the difficulty with a partial equilibrium model is that the effects of changes in certain variables are simulated without specifying the reasons for which these changes occur. For example, the impact on the U.S. current account of a depreciation of the dollar may vary substantially depending on whether the depreciation reflected a cut in the fiscal deficit, a monetary expansion, or a shift in asset preferences. Because it treats the exchange rate as an exogenous variable, a partial equilibrium model cannot make distinctions of this kind. As a consequence, the simulated impact of exchange rate changes on the current account could be overstated in certain cases. For example, if the depreciation resulted from a shift in asset preferences against the U.S. dollar, economic activity and prices in the United States would be boosted while output and prices abroad would be lowered, thereby mitigating the initial improvement of the U.S. current account. In this case, a partial equilibrium model would tend to overstate the impact of exchange rate changes on the external balance. If, however, the depreciation resulted from a cut in the U.S. fiscal deficit, the results

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1/ The exchange rate variable used in the model is the nominal effective value of the dollar. In the baseline and in the simulations presented in Table 6, the real effective value of the dollar is defined in terms of relative GNP deflators of major industrial countries. In the baseline, the nominal exchange rate variable changes in such a manner that the ratio of the U.S. GNP deflator to deflators for other major countries adjusted for exchange rates remains unchanged. In the simulations illustrating the effects of a real depreciation of the dollar, the nominal exchange rate depreciates relative to its baseline value to produce the specified change in the real exchange rate.

probably would not be significantly biased over a period of several years, since the impact on U.S. GNP of the strengthening of the external balance would be offset in large measure by the withdrawal of fiscal stimulus.

1. Impact of exchange rate changes

Simulations A and B in Table 6 show the effects of a 5 percent and a 10 percent decline, respectively, in the real value of the dollar on major components of the U.S. current account. Initially, improvement in the current account balance largely stems from an improvement in the trade balance. Merchandise exports rise in response to enhanced price competitiveness of U.S. producers. This rise accelerates in the second year as foreign competitors unwind part of the initial absorption of the exchange rate change in their profit margins; it slows in the third year and is relatively steady thereafter. Merchandise imports in the first year rise in value but fall in volume; subsequently, they fall in both value and volume terms. The path of the decline in the value and volume of imports also is influenced by the pricing behavior of foreign exporters. Most of the improvement in the services balance results from an increase in net investment income receipts. In the first year, this increase primarily reflects a rise in direct investment income receipts owing to the effect of the depreciation of the dollar on the translation of earnings in foreign currencies into U.S. dollars. In subsequent years, the increase in net investment income receipts to a growing extent is due to lower portfolio investment income payments stemming from a less rapid buildup of external debt than in the baseline.

Simulations A and B also serve to illustrate the importance of the link in the model between the current account balance, the net international investment position, and net portfolio income payments. They give some indication of the nonlinearity of the model with respect to changes in exogenous variables which primarily results from the impact of a buildup in foreign debt on portfolio income payments. The larger depreciation of the dollar in simulation B leads to a more than proportional improvement in the current account balance. Largely because the adjustment in the external balance is more rapid and less external debt builds up, the improvement after five years in the current account balance in simulation B is more than twice as large as in simulation A. 1/

1/ The timing of a change in an exogenous variable, as well as its magnitude, is an important determinant of the ultimate impact on the current account deficit because of its influence on the buildup of foreign debt over time. Thus, a one-shot depreciation of the dollar will produce a larger improvement in the external balance than a depreciation of the same size spread out over a number of years.

Table 6. Sensitivity of the Current Account Model to Changes in Key Exogenous Variables 1/

(In billions of dollars)

Effect After	Years One	Two	Three	Four	Five
A. 5 percent decline in the real effective value of the dollar:					
Current account balance	15	35	42	50	61
Trade balance	11	28	33	37	44
Exports: Value	17	28	30	35	40
Volume (percent)	1.5	4.1	3.5	3.7	3.7
Imports: Value	6	--	-3	-2	-4
Volume (percent)	-1.6	-3.5	-3.9	-4.2	-4.4
Services and transfers, net	4	6	9	13	16
Investment income, net	3	4	7	10	13
Net international liability position	15	49	91	141	201
B. 10 percent decline in the real effective value of the dollar:					
Current account balance	31	74	89	105	128
Trade balance	22	60	70	79	94
Exports: Value	36	60	63	75	85
Volume (percent)	3.1	8.7	7.4	7.7	7.8
Imports: Value	13.5	-1	-6	-3	-9
Volume (percent)	-3.2	-7.1	-7.8	-8.3	-8.7
Services and transfers, net	9	13	20	26	35
Investment income, net	7	9	14	21	28
Net international liability position	31	105	194	299	427
C. 1 percentage point decrease in the rate of growth of economic activity in the United States:					
Current account balance	13	15	18	20	24
Trade balance	12	13	14	16	18
Exports: Value	--	--	--	--	--
Volume (percent)	--	--	--	--	--
Imports: Value	-12	-13	-14	-16	-18
Volume (percent)	-2.5	-2.5	-2.5	-2.5	-2.5
Services and transfers, net	1	2	3	5	6
Investment income, net	1	2	3	4	5
Net international liability position	13	28	46	66	90
D. 1 percentage point increase in the rate of growth of economic activity in the rest of the world:					
Current account balance	11	13	15	18	21
Trade balance	7	9	10	11	13
Exports: Value	7	9	10	11	13
Volume (percent)	1.9	1.9	1.9	1.9	1.9
Imports: Value	--	--	--	--	--
Volume (percent)	--	--	--	--	--
Services and transfers, net	4	5	6	7	8
Investment income, net	3	4	5	6	8
Net international liability position	11	24	40	58	79

1/ Figures in this table represent changes from a baseline which is derived by assuming a constant real value for the dollar and constant rates of growth (or levels as appropriate) for other exogenous variables. The baseline uses estimates for current account transactions in 1987 as its starting point. Thus the magnitude of the effects in billions of dollars of a change in any particular exogenous variable is dependent on these starting values. All the simulations reflect the impact of a one-shot change in the exogenous variable in the first year.

2. Impact of changes in economic activity

Simulations C and D in Table 6 illustrate the effects of changes in assumptions about economic activity. They suggest that a once-and-for-all 1 percent reduction in the level of U.S. GNP over the simulation period would produce a somewhat larger improvement in the current account balance than a similar increase in the level of economic activity in all other countries. 1/ The merchandise trade balance shows significantly greater improvement in simulation C than in simulation D, reflecting the somewhat higher income elasticity for U.S. imports than for U.S. exports. However, an increase in foreign economic activity has a somewhat greater impact on the service balance than a decrease in U.S. activity.

In simulation C, the improvement in the current account balance largely results from a reduction in merchandise imports. Effects on services are small initially, but they grow over time reflecting the impact of a slower accumulation of external debt relative to the baseline. In simulation D, roughly two thirds of the improvement in the current account balance comes from an increase in merchandise exports. The initial improvement in the services balance in large measure stems from an increase in direct investment income receipts; subsequently, a rising proportion of this improvement is related to the effects of slower debt accumulation on portfolio income payments.

If changes in the rate of growth of economic activity in the United States and other countries were sustained over a number of years, their impact on the U.S. current account balance would be larger than those derived by simply extrapolating from simulations C and D. This result again largely stems from the key role played by the buildup of foreign debt in determining the path of the external balance. A 1 percentage point decrease in the rate of growth of U.S. GNP sustained over five years would lead to an improvement in the current account balance of $13 billion after one year which rises to over $100 billion after five years. The merchandise trade balance would improve by $12 billion after one year and by $83 billion after five years. A sustained 1 percentage point increase in the rate of growth of output in all other countries would improve the U.S. current account by $11 billion after one year and

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1/ It should be noted that a 1 percent decrease in the level of U.S. GNP would produce a substantially larger improvement in the U.S. external balance than a comparable increase in the level of GNP in other industrial countries but not in the developing countries. Such an increase would improve the U.S. current account balance relative to the baseline by $8 billion after one year, $9 billion after two years, $11 billion after three years, $12 billion after four years, and $14 billion after five years; the trade balance would improve by $5 billion after one year rising to $7 billion after five years.

by $100 billion after five years, with the trade balance improving by $7 billion after one year and by $66 billion after five years. 1/

V. The Effects of the Depreciation of the Dollar on the U.S. Current Account Balance

In spite of the substantial decline in the real value of the dollar since March 1985, the U.S. current account deficit has continued to widen. This development has prompted a number of observers to express the view that changes in exchange rates have failed to bring about adjustment in the external imbalance. While it is true that the U.S. current account deficit has not declined, this does not mean that exchange rate changes have failed to promote external adjustment. To properly assess the impact of the depreciation of the dollar on the current account balance, the comparison that should be made is between the actual outcome and that which would have occurred in the absence of the decline in the value of the dollar.

Table 7 provides an illustration of the possible impact of the real depreciation of the dollar since early 1985 on the current account deficit and the net external liability position of the United States. The simulation is based on the assumption that the real value of the dollar would have remained at roughly its level in March 1985, while all other exogenous variables are assumed to take on their actual values during the period 1985-87. 2/ On this basis, the current account deficit would have reached $125 billion in 1985, $192 billion in 1986, and $290 billion in 1987. The results suggest that the depreciation of the dollar contributed to a significant improvement in the current account balance, on the order of $10 billion in 1985, $50 billion in 1986, and around $130 billion in 1987.

1/ A sustained 1 percentage point increase in the rate of growth of GNP in other industrial countries, but not in the developing countries, would lead to an improvement in the U.S. current account balance of $8 billion after one year and $66 billion after five years. The merchandise trade balance would improve by $5 billion after one year and by $36 billion after five years.

2/ It is likely that the evolution of other exogenous variables in the model (such as U.S. and foreign economic activity and prices) would have been significantly different if the dollar's value had remained at its level in March 1985. In the context of the partial equilibrium model presented here, it is not possible to account for such effects. For this reason the results are referred to as being illustrative of the magnitude of the adjustment in the U.S. external imbalance that has taken place.

Table 7. U.S. Current Account Balance:
Actual and Simulated Values 1985-87

(In billions of dollars)

	1985	1986	1987
Actual: 1/			
Current account balance	-116	-141	-160
Trade balance	-122	-144	-156
Services transfers, net	6	3	4
Investment income, net	25	21	10
Net international liabilities	112	264	400
Constant real value of the dollar at its March 1985 level:			
Current account balance	-125	-192	-290
Trade balance	-127	-179	-256
Services and transfers, net	2	-13	-25
Investment income, net	22	10	-9
Net international liabilities	121	324	590

1/ Data for 1987 are based on three quarter of actual data and estimates for the fourth quarter.

Most of the improvement in the current account relative to what would have been the case in the absence of the dollar's appreciation reflects the impact of the fall in the value of the dollar on the trade balance. However, a growing proportion of it can be attributed to net investment income receipts, reflecting the direct effects of the exchange rate change on direct investment income receipts and the impact on portfolio income payments of a slower accumulation of U.S. external debt stemming from the improvement in the current account balance. The United States shifted from a net international asset position that peaked at $141 billion at the end of 1981 to a net liability position of $112 billion in 1985, and that liability position is estimated to have risen to $400 billion in 1987. If the value of the dollar had remained at its March 1985 level, net U.S. international liabilities would have risen to around $120 billion in 1985 and to nearly $600 billion in 1987.

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A Model of U.S. Current Account Transactions

This appendix presents the behavioral equations and key identities in the model of U.S. current account transactions. Equations for the volume of exports and imports were estimated using annual data for the period 1974-86. 1/ The price equations were estimated using annual data for the period 1972-86. Equations for services transactions were estimated in current dollars using annual data for the same period. Throughout this appendix, a capital letter represents the level of a variable and a lower case letter represents its natural logarithm; numbers in parenthesis under the estimated coefficients are t-statistics. Variables are defined at the end of the appendix.

Equations for U.S. exports

Agricultural exports

To industrial countries

$$x_a^i = 7.08 + \underset{(5.7)}{1.60}\, y^i - \underset{(4.7)}{0.98}\, e_{-1} \qquad (1)$$

$\bar{R}^2 = 0.72$ D.W. = 1.62

To non-oil developing countries

$$x_a^d = 5.78 + \underset{(5.9)}{2.03}\, y^d - \underset{(3.2)}{1.19}\, b \qquad (2)$$

$\bar{R}^2 = 0.76$ D.W. = 1.05

Nonagricultural exports

To industrial countries

$$x_{na}^i = 2.88 + \underset{(9.6)}{1.90}\, y^i - \underset{(3.4)}{0.69}\, \pi^x - \underset{(2.1)}{0.60}\, \pi_{-1}^x \qquad (3)$$

$\bar{R}^2 = 0.92$ D.W. = 1.46

1/ One exception is the equation for petroleum consumption which was estimated using annual data for the period 1978-86.

To non-oil developing countries

$$x^d_{na} = 3.29 + \underset{(4.4)}{2.34}\, y^d - \underset{(3.5)}{1.26}\, \pi^x_{-1} - \underset{(3.9)}{0.69}\, b \qquad (4)$$

$\bar{R}^2 = 0.96$ D.W. = 2.00 RHO = $\underset{(3.3)}{0.71}$

Total exports to members of OPEC

$$x^{OPEC}_m = 6.82 + \underset{(7.1)}{0.55}\, y^{OPEC}_{-1} \qquad (5)$$

$\bar{R}^2 = 0.80$ D.W. = 1.26

Equations for U.S. imports

Nonpetroleum imports

$$m_{np} = -9.44 + \underset{(24.5)}{2.68}\, y^{US} - \underset{(3.6)}{0.57}\, \pi^m - \underset{(4.0)}{0.55}\, \pi^m_{-1} \qquad (6)$$

$\bar{R}^2 = 0.99$ D.W. = 3.05

Petroleum imports

$$M_p = C_{oil} - O_{prod} + O_{stk} + O_{dis} \qquad (7)$$

$$C_{oil} = (1 + \dot{C}_{oil}) * C_{oil-1} \qquad (8)$$

$$\dot{C}_{oil} = -0.03 + \underset{(3.9)}{0.91}\, \dot{Y}^{US} - \sum_{i=o}^{6} \alpha_i\, (\dot{\Pi}_{oil})_{-i} \qquad (9)$$

$\bar{R}^2 = 0.84$ D.W. = 1.89

Lag coefficients 1/

i	0	1	2	3	4	5	6	Sum
α_i	-0.06	-0.05	-0.04	-0.03	-0.02	-0.02	-0.01	-0.23 (3.7)

Equations for export and import prices

Deflator for U.S. nonagricultural exports

$$p^x_{na} = -1.80 + \underset{(8.1)}{0.94}\, p^{US} + \underset{(6.4)}{0.45}\,(p^f_x - e) + \underset{(5.0)}{0.30}\, p^{cp} \qquad (10)$$

$\bar{R}^2 = 0.99$ D.W. = 1.23

Deflator for U.S. nonpetroleum imports

$$p^m_{np} = -0.29 + \underset{(6.7)}{0.58}\,(p^f_x - e) + \underset{(6.5)}{0.40}\,(p^f_x - e)_{-1} + \underset{(2.5)}{0.09}\, p^{cm} \qquad (11)$$

$\bar{R}^2 = 0.99$ D.W. = 1.76

Foreign export prices

$$p^f_x = 4.55 + \underset{(5.1)}{1.09}\, p^f + \underset{(2.9)}{0.61}\, p^x_{na} - \underset{(2.8)}{0.41}\, p^x_{na-1} \qquad (12)$$

$$- 0.21\, p^x_{na-2} + \underset{(1.4)}{0.12}\, e - \underset{(0.1)}{0.01}\, e_{-1} - \underset{(0.7)}{0.11}\, e_{-2}$$

$\bar{R}^2 = 0.99$ D.W. = 2.66

1/ Lags on the relative price variable in the equation were estimated using a first-degree Almon polynomial with a zero end constraint.

Equations for U.S. service receipts

Travel and passenger fares

$$x_t = -4.20 + \underset{(16.0)}{1.37}\, y^i - \underset{(8.3)}{0.45}\, \pi^t - \underset{(8.3)}{0.30}\, \pi^t_{-1} \qquad (13)$$

$$- \underset{(8.3)}{0.15}\, \pi^t_{-2} + \underset{(5.8)}{0.17}\, D_{mt}$$

$\bar{R}^2 = 0.98$ D.W. = 1.84

Transportation

$$\Delta x_f = -0.02 + \underset{(6.2)}{0.63}\, \Delta x_m + \underset{(1.8)}{0.19}\, \Delta m_m + \underset{(2.8)}{0.08}\, \Delta p^m_p + \underset{(2.2)}{1.11}\, \Delta p^{US} \qquad (14)$$

$\bar{R}^2 = 0.88$ D.W. = 2.50

Other services

$$x_o = 0.20 + \underset{(56.4)}{0.96}\, x_{o-1} \qquad (15)$$

$\bar{R}^2 = 0.99$ h = 0.47

Direct investment income

$$\Delta x_{di} = -0.20 + \underset{(6.1)}{7.09}\, \Delta y^i - \underset{(1.7)}{0.90}\, \Delta e - \underset{(0.3)}{0.17}\, \Delta^2 e \qquad (16)$$

$$+ \underset{(2.3)}{0.21}\, \Delta p^m_p + \underset{(3.6)}{0.26}\, D_{di}$$

$\bar{R}^2 = 0.93$ D.W. = 1.89

Portfolio income receipts

$$X_{pi} = I^{a} * A^{us} \tag{17}$$

Equations for U.S. service payments

Travel and passenger fares

$$m_t = -14.06 + \underset{(12.5)}{1.32}\, y^{US} + \underset{(13.1)}{1.20}\, \pi^{t} + \underset{(1.4)}{0.15}\, \pi^{t}_{-1} \tag{18}$$

$\bar{R}^2 = 0.97$ D.W. 0.88

Transportation

$$\Delta m_f = -0.01 + \underset{(6.5)}{0.58}\, \Delta x_m + \underset{(7.8)}{0.61}\, \Delta m_m + \underset{(3.4)}{0.10}\, \Delta p^{m}_{p} + \underset{(1.3)}{0.52}\, \Delta p^{f} \tag{19}$$

$\bar{R}^2 = 0.94$ D.W. 2.39

Other services

$$m_o = 0.15 + \underset{(25.6)}{0.96}\, m_{o-1} \tag{20}$$

$\bar{R}^2 = 0.98$ $h = -0.63$

Direct investment income

$$m_{di} = -9.68 + \underset{(7.3)}{1.42}\, (y^{US} + p^{US}) \tag{21}$$

$\bar{R}^2 = 0.80$ D.W. 1.28

Portfolio income payments

$$M_{pi} = I^{l} * L^{US} \tag{22}$$

Definition of variables

A^{US} = average U.S. private holdings of claims on foreigners and foreign securities.

B = ratio of external debt of non-oil developing countries to their exports of goods and services.

C_{oil} = volume of petroleum consumption in thousands of barrels per day.

$\dot{C}_{oil}$ = percent change in the volume of U.S. oil consumption.

D_{di} = dummy for direct investment receipts equal to one in 1979 following the completion of the takeover of a major foreign affiliate of a U.S. oil company.

D_{mt} = dummy for Mexican purchases in the border area, equal to one in 1981 and 1982, periods prior to major devaluations of the Mexican peso.

E = index of the effective value of the dollar.

I^{a} = average yield on U.S. private holdings of claims on foreigners and foreign securities.

I^{l} = average yield on foreign holdings (including holdings of foreign official agencies) of U.S. private liabilities and of U.S. securities, including U.S. government securities.

L^{US} = average foreign holdings (including holdings of foreign official agencies) of U.S. private liabilities and U.S. securities, including U.S. government securities.

M_{di} = U.S. income payments on foreign direct investment in the United States.

M_{f} = U.S. payments for transportation services.

M_{m} = total U.S. merchandise imports in constant dollars.

M_{np} = U.S. nonpetroleum imports in constant dollars.

M_o = U.S. payments for other services, including fees and royalties and miscellaneous services purchased by U.S. private residents and the U.S. Government.

M_p = volume of U.S. petroleum imports.

M_{pi} = U.S. portfolio income payments.

M_t = U.S. payments for travel and passenger fares in constant dollars.

O_{dis} = the sum of timing and definitional differences between oil imports derived from the consumption, production, and stocks data and imports in the balance of payments statistics, in thousands of barrels per day.

O_{prod} = domestic petroleum production, in thousands of barrels per day.

O_{stk} = change in petroleum stocks (including the Special Petroleum Reserve), in thousands of barrels per day.

P^{cm} = weighted average index of world non-oil commodity prices.

P^{cp} = deflator for computer equipment in the U.S. national income accounts.

P^f = weighted average of implicit price deflators for GNP of six major industrial countries in local currency terms. 1/ Weights are based on shares of these countries in U.S. trade.

P^f_x = weighted average of export prices of six major industrial countries in local currency terms. 1/ Weights are based on shares of these countries in U.S. trade.

P^i = weighted average of the consumer price indexes in the industrial countries; weights are based on 1980 nominal GNPs for these countries.

P^{US} = implicit price deflator for U.S. GNP.

P^x_{na} = deflator for U.S. nonagricultural exports.

P^m_{np} = deflator for U.S. nonpetroleum imports.

P^m_p = deflator for U.S. petroleum imports.

1/ Canada, France, Germany, Italy, Japan, and the United Kingdom.

Π^m = relative price index for nonpetroleum imports, defined as the ratio of the price deflator for U.S. nonpetroleum imports to the implicit price deflator for U.S. GNP.

Π_{oil} = percent change in the relative price of oil, defined as the ratio of the U.S. producer price index for petroleum products to the implicit price deflator for U.S. GNP.

Π^t = relative price index for travel and passenger fares, defined as the ratio of the implicit price deflator for U.S. GNP to a weighted average of consumer prices of major industrial countries adjusted for exchange rate changes.

Π^x = relative price index for nonagricultural exports, defined as the ratio of the U.S. nonagricultural export deflator to the weighted average of export prices of six major industrial countries, adjusted for exchange rates.

X_a^d = U.S. agricultural exports to non-oil developing countries in constant dollars.

X_a^i = U.S. agricultural exports to industrial countries in constant dollars.

X_{di} = U.S. income receipts from direct investments abroad.

X_f = U.S. receipts from transportation services.

X_m = total U.S. merchandise exports in constant dollars.

X_m^{OPEC} = total U.S. exports to OPEC members in constant dollars.

X_{na}^d = U.S. nonagricultural exports to non-oil developing countries in constant dollars.

X_{na}^i = U.S. nonagricultural exports to industrial countries in constant dollars.

X_o = U.S. receipts from other services, including fees and royalties and miscellaneous services provided by U.S. private residents and the U.S. Government.

X_{pi} = U.S. portfolio income receipts.

X_t = U.S. receipts for travel and passenger fares in constant dollars.

Y^d = export-weighted average of regional indexes for constant dollar GNP of non-oil developing countries in the Western Hemisphere, Asia, and Africa.

Y^i = weighted average of indexes of constant dollar GNP for six major industrial countries. 1/

Y^{OPEC} = purchasing power of oil-exporting countries, defined as export revenues deflated by a weighted average consumer price index for these countries.

Y^{US} = U.S. GNP in constant dollars.

$\dot{Y}^{US}$ = percent change in U.S. GNP in constant dollars.

1/ Canada, France, Germany, Italy, Japan, and the United Kingdom.

Methodology for Assessing Sources of Changes in Trade Flows

This appendix describes the methodology used to quantify the impact of changes in key explanatory variables on U.S. trade flows. In the trade sector of the current account model, the volume of trade corresponding to a particular category of goods ($\bar{T}$) is generally specified as a log-linear function of an economic activity variable (Y), a relative price term relating the prices of goods in the particular trade category to the prices of competing goods (Π), and other relevant explanatory variables (V). This relationship takes the general form:

$$\bar{t} = b_o + b_1 y + b_2 \pi + b_3 v + u \qquad (1)$$

where a lower case letter represents the natural logarithm of the corresponding variable and u is a random error term.

The effects of the explanatory variables on the change in the volume of the trade flow can be derived by noting that $\Delta\bar{t} \approx \Delta\bar{T}/\bar{T}_{-1}$. Substituting this relationship into equation (1) yields:

$$\Delta\bar{T} \approx (b_1 \Delta y + b_2 \Delta\pi + b_3 \Delta v + \Delta u)\bar{T}_{-1} \qquad (2)$$

This equation expresses the change in the volume of trade as a weighted sum of the changes in the explanatory variables and changes in the random error term, all scaled by the volume of trade in the preceding year.

The value of trade (T) is equal to the appropriate price variable (P) times the volume. Therefore:

$$\Delta T \cong P_{-1}\Delta\bar{T} + \bar{T}\Delta P \qquad (3)$$

Substituting for $\Delta\bar{T}$ from equation (3) in equation (2) and solving for ΔT yields:

$$\Delta T = T_{-1}\ (b_1 \Delta y + b_2 \Delta\pi + b_3 \Delta v) + T(\Delta P/P) + T_{-1}\Delta u \qquad (4)$$

Equation (4) was used to estimate the impact of movements in U.S. and foreign economic activity, prices, and other factors on U.S. merchandise exports and imports.