Merchandise Trade Balances of Less Developed Countries and Exchange Rate of the U.S. Dollar: Cases of Iran, Venezuela and Saudi Arabia

Ayoub Yousefi
Department of Economics
University of Waterloo
200 University Avenue West
Waterloo, Ontario N2L 3G1

February 2000

Abstract

This study examines the effects of changes in the exchange rate of the U.S. dollar on the trade balances of three oil-exporting countries, Iran, Venezuela, and Saudi Arabia. An exchange rate pass-through model is applied to allow changes in the exchange rate of the dollar to affect prices of traded goods. We found that changes in the effective exchange rate of the dollar pass through partially to these countries' import prices. For the export prices, under the floating exchange rate system depreciation of the dollar was found to cause export prices of these countries (except Saudi Arabia) to rise. While changes in the exchange rate of the dollar influence these countries' trade balances, the long-run trade balance adjustments seem to follow different patterns and time profiles.

Key Words: Trade Balance, J-curve, Invoicing Currency, Exchange Rate pass-through, and Crude Oil.
JEL Classification: F31, F32, and F14

This paper grew out of Yousefi (1992, Ch. 3). The author would like to thank Paul Davidson, Don P. Clark, Hui S. Chang, and George Philippatos for their useful remarks on an earlier draft of this paper.

1. Introduction

The adjustment pattern of a nation's trade balance in response to changes in its exchange rate has been one of the most controversial issues in the international trade literature. The unprecedented dramatic swings in the exchange rate of the US dollar during the 1980's sparked a new wave of interest in this area. Numerous empirical studies were launched to examine the causes of the sluggish response of the U.S. nominal trade deficit to the continuous depreciation of the dollar since the first quarter of 1985, Deyak et al. (1990), Hooper and Mann (1989), Koch and Rosenswieg (1988), Krugman and Baldwin (1987), Mann (1986), Meade (1988), and Moffett (1989).[1]

According to the standard textbook view, a depreciation of the deficit nation's currency vis-a-vis a trade-partner's currency immediately raises the relative-price of imports with little or no decline in volume. Therefore, the trade balance deteriorates, assuming that the initial trade balance was zero. Over time, the volume effect comes to dominate the relative-price effect and the trade balance improves. This pattern of trade balance adjustment is commonly referred to as the "J-curve effect. The J-curve effect presupposes the ‘Marshall-Lerner condition’ that price elasticities of demand for imports and exports sum to greater than unity. In addition to the elasticity condition, another equally crucial prerequisite for the J-curve effect to take place is the currency denomination of import and export contracts, Magee (1973). If an exporter or importer uses a foreign currency in his foreign trade contracts, his revenue or costs in terms of domestic currency will be immediately affected when the exchange rate changes. On the contrary, if he uses his own currency, a change in the exchange rate will leave his revenue or costs unaffected.

Theoretical explanation of the choice of invoicing currency was pioneered by Magee (1973, 1974), McKinnon (1979), and Magee and Rao (1980) and followed by Melvin and Sultan (1990), among others. Although only a few theoretical studies exist on this issue, empirical examinations are even fewer.[2]

In the absence of an international currency, international contracts must be denominated in terms of the domestic currency of one nation. In the case of many primary commodities, such as minerals, agricultural products, and crude oil, international contracts are almost universally denominated in a single currency (e.g., the U.S. dollar) independent of the nation of residency for buyer and seller. Despite its pivotal role as a catalyst in the transmission of changes in the exchange rate to the trade balance, it was not until early in the 1970s that most European countries began to collect data on the invoicing currency. Today, information on invoicing currency is available for most European countries and for Japan. There is, however, little reliable currency information on the rest of the world, including

[1] During the 1985:I-1988:II period, about three years, the trade-weighted average value of the dollar measured against the currencies of G-10 countries declined by over 42 percent. Despite this precipitous decline in the dollar's value, the U.S. nominal trade deficit continued to rise from $ 23.38 billions in 1985:I to $ 42.47 billions in 1987:III.

[2] For instance, empirical investigations on the currency denomination of international contracts for the UK, Italy, and the European Union have been carried out by Carse, Williamson, and Wood (1980), Basevi, eds., (1987), and Leuvensteijn (1994), respectively.

the United States.

The invoicing currencies for the European countries and Japan, as well as estimates for the other countries, have been tabulated by Page (1981), Tables 1 and 2. In addition, data on the invoicing currency of trade for six major industrialized countries in 1988 have been compiled by Tavlas and Ozeki (1991), Table 3. Some features of the invoicing currency of trade from these tables are noteworthy. First, for almost all of the countries listed in Table 1, the share of own currency used in invoicing exports is greater than the corresponding figure for invoicing imports, see columns 4 and 8. This phenomenon could also be observed in the 1988 data, Table 3, columns 1 and 3. Second, the currencies of large countries are used more than those of small countries in denominating international contracts. For instance, more than half of the world trade, 54.8 percent, is priced in terms of the US dollar, Table 2, column 3.[3] Finally, very little trading is invoiced in the currencies of developing countries.

Nonetheless, the studies that investigate the exchange-rate responsiveness of developing countries' trade balances focus on changes in the exchange rates of the domestic currencies of these countries, see Bahmani-Oskooee (1984, 1986). A serious drawback with these studies is the failure to recognize that many developing countries' currencies are inconvertible. This fact makes it impossible for these currencies to be chosen as an invoicing currency or as a means of international payments. Moreover, the major portion of these countries' exports are primary commodities which are traditionally invoiced and paid for in terms of the U.S. dollar. For instance, 85 percent of exports from developing countries are invoiced in terms of the US dollar, Table 1. Consequently, variations in the exchange rates between the US dollar and major currencies are expected to influence the trade balances of these countries.

Among major commodity groups crossing national boundaries, petroleum invoicing currency is the most homogenous of all. Indeed, 100 percent of trade involving crude oil is invoiced in terms of the U.S. dollar, a figure even greater than the corresponding one for exports from the U.S., 98 percent, Table 1. In addition, for the OPEC members, export of oil has been more than 90 percent of their total exports over the last two decades. These are distinct criteria that pull together oil exporting countries whose foreign trade predominantly invoiced in US dollars. Consequently, the explicit account of the invoicing currency makes these countries suitable candidates for trade balance adjustment investigations. Considering the limited amount of data of interest for some of these countries, I have chosen a group of countries by a process of elimination. This group of countries, hereafter called the

[3] Table 1 shows that the U.S., German, and British shares of exports in their own currencies are greater than their share of imports in foreign currencies. For instance, the estimated figure of the share of U.S. exports invoiced in dollars is 98 percent, while the share of its imports invoiced in other currencies is only 15 percent, (1 - 85%). For countries with a high share in world trade, share of their own currency in invoicing exports is very high, except for Japan. Specifically, only 2 percent of exports to Japan is invoiced in Yen, whereas 93 percent invoiced in dollars.

Table 2 suggests that while total U.S. exports account for 11.7 percent of world exports, the dollar's share in world exports is 54.8 percent. Hence, if the dollar's share in world exports is adjusted for the U.S.' own exports, [54.8 - (54.8 × 11.7%)], 48.4 percent of the use of the U.S. dollar is accounted for by its potential use as a "third- country currency," or as "vehicle currency,"see Magee and Rao (1980).

"study group countries," consists of Iran, Saudi Arabia, and Venezuela, three major oil exporting countries out of the five founding members of OPEC, two from the Middle East and one from the western hemisphere.

The rest of the paper is organized as follows: Section 2 develops the model and estimation methodology. Section 3 provides a summary of empirical results. Section 4 contains the conclusions and policy implications.

2. Model and Estimation Methodology

The volume of a country's imports depends on two independent variables: real income and relative prices (import prices divided by the domestic prices of import substitutes), where a degree of substitutability between imports and domestically produced goods is assumed. Similarly, demand for a country's exports is defined as a function of the trading partners' real income and the ratio of export prices to the price level of the importing countries. In addition, because exchange rate variations change the actual price paid or received for traded goods, causing adjustments in quantities traded, it is necessary to incorporate an exchange rate variable in the demand equations. Thus, the import and export demand relationships can be expressed as:

$$M^d_{it} = f\ \{\ Y_{it}\ ,\ (\ PM_{it}\ /\ PDM_{it}\ ),\ E_t\ \} \tag{1}$$

$$X^d_{it} = h\ \{\ W_t\ ,\ (\ PX_{it}\ /\ PFM_{it}\ ),\ E_t\ \} \tag{2}$$

where M^d_{it} is the quantity of imports demanded by country i, Y_i is the real income of country i, PM_i is the import prices by country i, PDM_i is the domestic prices of import substitutes of country i, E is the exchange rate (foreign currency units per unit of domestic currency), X^d_i is the quantity of exports demanded by the trading partners, W is the trading partners' real incomes (computed as weighted averages across trading partner countries), PX_i is the export prices by country i, and PFM is the foreign price index (computed as weighted averages of the price indexes in trade partner countries).

The model will be estimated for the stability of relationships over both the Bretton Woods fixed exchange rate period and over the current floating rate period. The distinction between the two exchange rate regimes is made to account for the infrequent, but potentially important devaluations during the former system and more frequent fluctuations in the current exchange rate regime.

Our immediate concerns are the theoretical foundations of these relationships and the validity of the functional forms employed for (1) and (2) as well as problems involved with their estimation.

2.1 Simultaneity Problem

The estimates of the price elasticities of demand for imports and exports derived from equations (1) and (2) can be biased and inconsistent because of simultaneity between prices and quantities. Such estimates are weighted averages of the true elasticities of demand and supply, rather than estimates of the price elasticity of demand. More specifically, simultaneity implies correlation between the determinant variables in an equation and the error term. Such a correlation would violate one of the basic conditions for the use of the Ordinary Least Squares (OLS) technique for the estimation of the single import and export demand equations, see Kmenta (1986).

In dealing with trade flow analysis, it has been traditional to ignore the supply side of exports and imports by making an assumption that the price elasticity of supply is infinite. In other words, import and export prices have been considered exogenous to any given country. This assumption has been adopted, not because a nation's export supply elasticity is infinite, but because of the fact that it is one of many suppliers.

Several different arguments have been made to support the exogeniety assumption. Murry and Ginman (1975) refer to firms operating at less than full-employment capacity, implying that the industry supply curve will be horizontal before the full-capacity production level is reached. Also Warner and Kreinin (1983) employ import prices in terms of foreign currency in order to apply the OLS estimation technique.

Despite the procedures mentioned above in support of the exogeniety of import and export prices, heterogeneity of manufactured commodities and imperfect competition allow different market prices to exist for similar, but not identical, products in the market. In addition, the existing empirical evidence suggests that, being concerned with the market shares following a prolonged overvaluation of the home currency, exporters do exercise a certain degree of control over prices. For the group countries, given the high proportion of oil in total exports and the invoicing currency, export prices are expected to respond, to some extent, to changes in the exchange rate of the US dollar. Moreover, the oil industry in these countries is heavily dependent upon many imports used as inputs. The increased cost of imports, following a depreciation of the US dollar, is expected to add significantly to the overall cost of production and trigger a rise in export prices. As a result, the treatment of import and export prices in this study is not based on the assumption of infinite price elasticity of supply. Rather, the appropriate procedure is to formulate a complete model, including import and export supply functions. Thus, specification of separate price equations serves to eliminate the problem of simultaneous equation bias in the single-equation estimation.

Following Moffett (1989), we consider explicit price equations in addition to the demand equations for imports and exports. These equations are expected to reflect the dynamic impact of changes in the exchange rates and supply conditions on the price of traded goods.

2.2 Exchange Rate Pass-through

Exchange rate pass-through reflects the degree by which a nominal devaluation translates to a real devaluation. That is, with a successful pass-through, the relative price change will be substantial and the adjustment costs will be borne by the importers.[4] Enough empirical evidence exists to suggest that exporters react to changes in the exchange rate by adjusting their export prices in terms of their

[4] Hooper and Mann (1989:I) define the pass-through as the partial derivative of the import price with respect to the nominal exchange rate in a model that relates import price to the exchange rate and other variables.

domestic currencies in order to limit increases in the foreign currency prices of these products.[5]

The inertia in improvement of the U.S. nominal trade deficit following the drastic decline of the dollar from its 1985:I peak intensified researchers' attention over the mark-up pricing behavior of trade partners. For instance, the study by Hooper and Mann (1989:I) suggests that for U.S. imports of manufactured goods, on the average, 40 to 50 percent of the decline in the nominal exchange rate is absorbed by foreign firms (cutting profit margins) in order to minimize the losses of market share in the United States. This study also concludes that Japanese firms apparently absorb a higher proportion of exchange rate fluctuations into their profit margins on sales to the United States than they do on their sales to other countries. Also, Moffett (1989) examines the degree of exchange rate pass-through and its sensitivity to estimation sample periods during 1967:I-1987:IV for the U.S. import prices. The study suggests that the degree of exchange rate pass-through has been continually declining over the three sub-periods, 1967:I-1980:I, 1967:I-1985:I, 1967:I-1987:IV. But, in general, the degree of exchange rate pass-through, 53 percent over the entire period, is not much different from that found in similar studies.[6]

The study on pricing to market across destination countries by Gagnon and Knetter (1990), however, does not provide much support for the view that foreign exporters tend to exercise pricing to market toward the U.S. more than to other destinations, and Japan and Germany do more pricing to market than other source countries. The study also acknowledges the sharp differences in pricing to market behavior across source countries.

The study group countries' international transactions are not different from those of industrial countries given that their export receipts and thus their potential foreign expenditures are entirely in U.S. dollars. It would seem plausible that changes in the exchange rate of the dollar will pass through to their import and export prices. That is, the U.S. dollar exchange rate and prices, in terms of U.S. dollars, may not be statistically independent of each other and should not be utilized as explanatory variables in a single-equation demand function.

The model, therefore, is a four-equation representation of prices and quantities of merchandise imports and exports. Prices or supply equations are included in addition to demand equations, which have traditionally been used by themselves to study trade flows.[7] The model will be estimated in two stages. First, prices of imports and exports, in terms of U.S. dollars, are estimated from some explanatory variables, including the exchange rate of the U.S. dollar, variables representing supply

---

[5]The price discrimination in international trade that is triggered by exchange rate movements has been referred to as "pricing to market," Krugman (1987).

[6] Other researchers have focused more on the timing of exchange rate pass-through. Koch and Rosenswieg (1990) concluded that, unlike the presumption by the standard J-curve theory which calls for a rapid response of import prices, it takes a lag exceeding one year before U.S. import prices react significantly to changes in the dollar's value. These results support the growing evidence of unusually long delays (from the viewpoint of J curve theory) in U.S. import price pass-through. In addition, a study by Deyak et. al. (1990) suggests that the lag from a change in exchange rates to changes in import prices is approximately two years.

[7] For a more explicit rationale for this modeling see Ahluwalia and Hernandez-Cata (1975), Winters (1976) and especially Hooper (1976).

conditions and competitive factors. Second, the prices of imports and exports derived in the first stage with other variables, such as an activity variable, constitute factors which determine quantities of imports and exports. Thus, the effect of changes in the exchange rate on the merchandise trade balance is allowed to appear in two consecutive

phases. First, the long-run impact of exchange rate fluctuations on the prices of the traded goods, the pass-through effect, is estimated. Second, the transmission of changes in the exchange rate is followed through the impact of changes in the real exchange rate on the trade balances.[8]

Following Krugman and Baldwin (1987:I), Hooper and Mann (1989:I), and Deyak et. al. (1990), merchandise import and export prices could be expressed in the following functional forms:

$$PM_{it} = f\ (\ PFM_t,\ E_t\ ) \qquad (3)$$

$$PX_{it} = h\ (\ PDM_t,\ E_t\ ). \qquad (4)$$

The import and export prices are assumed to be negatively related to the exchange rate (foreign currency units per dollar) and positively related to wholesale price indexes in foreign countries and at home, respectively.[9]

The study of the U.S. trade flows for the 1958-1985 period by Deyak et. al. (1990) suggests that the impact of quantity variables over import and export prices are not significantly different from zero. Also, Krugman and Baldwin (1987:I), by using quarterly data from 1977:II through 1986:IV, suggest that there does not appear to be any significant effect of U.S. aggregate demand on import prices.[10] Moreover, Haynes and Stone’s (1983b) estimates of the supply of imports and exports for the U.S. and U.K., suggest that more appropriate specification of aggregate supply behavior is a supply-price not a supply-quantity specification. Given the lack of empirical support for the significance of a quantity variable, neither scale variables nor import-export quantities will be incorporated in the group countries’ price equations.

For estimation purposes, the equations will be used in their log-linear form.[11] Moreover, to

[8] For a direct relationship between changes in the exchange rate of the dollar and the trade balance, see appendix A.

[9] This presumption is consistent with the empirical estimates of the price elasticities of demand for imports of manufactured goods by the U.S., Moffett (1989).

[10] A partial list of studies that have addressed the transmission of changes in nominal exchange rate to trade balance through import prices includes: Stern, Baum, and Greene (1979); Haynes, Hutchinson, and Mikesell (1986); Gerald, Nicholas, and Peter (1987). Also, these studies suggest no evidence of lags in the effect of real expenditure (GDP+IM-EX) on imports reaching beyond one quarter. That is, the income effect works much more quickly than the price effect.

[11] Despite its economic properties, such that estimated coefficients are interpreted as elasticities with respect to corresponding variables, log-linear form brings some restriction into the model. For example, log-linear

capture the timing and magnitude of the impact of changes in the exchange rate, as well as domestic and foreign prices, on import and export prices a lag structure will be imposed on the explanatory variables.

$$\text{Ln } PM_t = \alpha_0 + \sum_{i=0}^{m1} a_{1i} \text{ Ln } PFM_{t-i} + \sum_{i=o}^{m2} a_{2i} \text{ Ln } E_{t-i} + \mu_t \quad (5)$$

$$\text{Ln } PX_t = \delta_0 + \sum_{i=0}^{n1} d_{1i} \text{ Ln } PDM_{t-i} + \sum_{i=0}^{n2} d_{2i} \text{ Ln } E_{t-i} + \nu_t \quad (6)$$

where μ_t and νt are the stochastic disturbance terms assumed to be identically and independently(i.i.d) distributed with zero mean and constant variances. The predicted prices of imports and exports along with other independent variables constitute explanatory variables of the quantity equations. In the meantime, should the impact of exchange rate changes on the import and export prices turn out to be insignificant, the proxies of import and export prices (import and export unit-value indexes) will be utilized in the quantity equations. This situation is perceived to be the more likely case for the Bretton Woods system as exchange rate and the group countries' export unit values remained almost constant. Finally, the quantity equations could be written as follows:

$$\text{Ln } M^d_{it} = \beta_0 + \beta_1 \text{ Ln } Y_{it} + \beta_2 \text{ Ln } (PM_i / PDM_i)_t + \varepsilon_t \quad (7)$$

$$\text{Ln } X^d_{it} = \gamma_0 + \gamma_1 \text{ Ln } W_{it} + \gamma_2 \text{ Ln } (PX_i / PFM)_t + \eta_t \quad (8)$$

where ε_t and η_t are the stochastic disturbance terms assumed to be identically and independently(i.i.d) distributed with zero mean and constant variances. Because the relative prices enter directly into equations (7) and (8), the signs and magnitudes of β_2 and γ_2, are the question to which we turn next.

2.3 Relative Prices

When the relative prices are used in a log-form demand equation for imports, the own-price elasticity is constrained to be equal in magnitude but opposite in sign to the domestic substitutes price elasticity of demand for import. Analogously, in the case of the export demand equation, export price elasticity would be equal in magnitude but opposite in sign to the foreign price elasticity. This constraint, however, is questionable on several grounds: First, even a model that assumes that the true values of the elasticities with respect to the prices of import goods and domestic substitutes are equal in absolute value should allow the estimated elasticities with respect to the price indexes, the import unit value index, and domestic price index to differ because of the methodological differences in the way these indexes are constructed. Second, since the full impact of changes in the exchange rate on import price and domestic price are expected to occur over time, it is quite conceivable that the pattern of dynamic influence--lag distribution--will be different. As such, some studies have investigated the validity of application of the relative price in international trade analysis. Murray and Ginman (1975), by using

demand for imports implies that i) importers will respond in proportion to a rise or a fall in the explanatory variables, and ii) elasticities will remain unchanged during the given range for each explanatory variable.

unadjusted quarterly data for Canada covering 1950 through 1964, concluded that the relative price specification of the traditional import demand model is inappropriate for estimating aggregate import demand parameters. Also, there are other studies which reject composite relative price variables. Augustine and Afifi (1987), in an effort to specify and estimate appropriate import demand functions for thirty developing countries over the 1960-1982 period, concluded that consumers tend to respond faster to changes in the price of domestic goods than to equal changes in import prices. Warner and Kreinin (1983) estimated import and export demand functions for most industrial countries and for 15 LDCs by separating the relative price variable into three components: domestic price, import price in foreign currency, and exchange rate. Their results suggest that in most countries, it does not appear justified to employ a composite relative price variable, since separation into its components yields more accurate results. Moreover, since an import price index based on unit values and a domestic price index may refer to different points in time, it is inappropriate to impose homogeneity through the use of relative price variables. Given the validity of these arguments, separated prices will be adopted as follows:

$$\text{Ln } M^d_{it} = \beta_0 + \beta_1 \text{ Ln } Y_{it} + \beta_2 \text{ Ln } PM_{it} + \beta_3 \text{ Ln } PDM_{it} + \varepsilon_t \qquad (9)$$

$$\text{Ln } X^d_{it} = \gamma_0 + \gamma_1 \text{ Ln } W_{it} + \gamma_2 \text{ Ln } PX_{it} + \gamma_3 \text{ Ln } PFM_{it} + \zeta_t \qquad (10)$$

Equations 5 and 9 together describe aggregate imports market and (6) and (10) describe aggregate exports markets. The estimates of the real income coefficients are expected to be positive and those of the import and export prices, negative. Except for the volume and associated price, the remaining variables are assumed exogenous. Furthermore, the model abstracts from other related issues such as monetary adjustments, changes in interest rates, and capital flows.

2.4 Static vs. Dynamic Models and Lag Structure

Although most traditional studies are based on equilibrium assumptions, they are prone to serious specification problems. Indeed, if imports and exports fail to adjust instantaneously to their long-run equilibrium levels following a change in any of the factors that influence their behavior, then the estimates of the price and real income elasticities would be biased and inconsistent.

The equilibrium model has been adapted by Augustine and Afifi (1987) and Khan (1974). Augustine and Afifi conclude that, on an annual basis, a static equilibrium model may be justified. Similarly, Khan's study of 15 developing countries for 1951-1969, on an annual basis, shows that for both import and export equations, a simple equilibrium formulation is adequate, where for both imports and exports the estimated adjustment period in response to changes in any explanatory variable is one year (the interval between observations).

The recent empirical research on the trade flows, however, provides convincing evidence on the sluggishness of the response of trade flows to price changes, Deyak et. al. (1990), Meade (1988) and Koch and Rosenswieg (1990). In the presence of imperfect information, product differentiation, adjustment costs and other market imperfections, adjustment of the dependent variable to changes in its explanatory variables may not be instantaneous. That is, the quantities of import and export demanded at each given relative price and real income may not be identical with the actual quantities traded.

A simple approach for modeling a dynamic trade relationship would be a framework of a distributed-lag model, as the effect of an explanatory variable on the dependent variable could be distributed across time. We provide two popular rationales for the geometric-lag distributed model:

1) The "adaptive expectations model," which assumes that the actual quantity of imports, M, is a function of, let us say, the expected value of X at time t+1, X^*_{t+1}. This relationship and its auxiliary hypothesis about expectation formation could be written as

$$M_t = \alpha + \beta X^*_{t+1} + \varepsilon_t \qquad (11)$$

$$(X^*_{t+1} - X^*_t) = (1-\lambda)(X_t - X^*_t) \qquad (12)$$

where ε_t is a stochastic disturbance term with zero mean and constant variance and $0 \le \lambda < 1$.

2) the "partial adjustments model," which assumes that the desired level of imports at time t, M^*_t, is a linear function of some explanatory variable X_t as

$$M^*_t = \alpha + \beta X_t + \varepsilon_t \qquad (13)$$

Clearly, the values of M^*_t are not directly observable, but we assume that imports adjust to the difference between the desired level of imports and its actual level in the previous period:

$$(M_t - M_{t-1}) = (1-\gamma)(M^*_t - M_{t-1}) + \mu_t \qquad (14)$$

where μ_t is a disturbance term with zero mean and constant variance, $(1-\gamma)$ is the speed of adjustment and $0 \le \gamma < 1$. Successive substitution of X_t for X^*_t in the adaptive expectations model and M_t for M^*_t in the partial adjustments model yield a geometric-lag distributed model, with an infinite number of lags.

The lag effects are necessary in circumstances where production and delivery take time and institutional or structural rigidities prevail. A plausible microeconomic justification for the lags, however, is the fact that they represent short-run supply inelasticity due to the limits on the speed at which trade flows respond. The lag effects and their magnitudes depend on a variety of factors, including trading countries' behavior over the choice between profit margins and market shares. Unfortunately, there is no theoretical basis for application of any specific lag model. Therefore, the timing, the lengths, and the pattern of adjustments in the lag effects remain to be determined by empirical investigation. To this end, we adopt dynamic quantity equations as follows:

$$LnM^d_t = \beta_0 + \beta_1 \, Ln\, Y_t + \sum_{i=0}^{m1} \beta_{2i} \, Ln\, PM_{t-i} + \sum_{i=0}^{m2} \beta_{3i} \, Ln\, PDM_{t-i} + \varepsilon_t \qquad (15)$$

$$LnX^d_t = \gamma_0 + \gamma_1 \, Ln\, W_t + \sum_{i=0}^{n1} \gamma_{2i} \, Ln\, PX_{t-i} + \sum_{i=0}^{n2} \gamma_{3i} \, Ln\, PFM_{t-i} + \nu_t \qquad (16)$$

Among the different distributed-lag models, geometric-lag models are awkward for the purpose of trade flow analysis for the following reasons:

First, the infinite number of lags implies that the effects of explanatory variables on dependent variables extend indefinitely into the past and that the coefficients decline at a constant rate such that the value of distant lags eventually become negligible. That is, the geometric-lag models assume that the largest effect of any changes in the explanatory variables occurs in the initial periods, and declines geometrically over time. Although application of the Koyck transformation procedure resolves the problems involved with estimation of the infinite-lag variables, an infinite number of lags is not appealing on theoretical grounds. Second, the Koyck transformation restricts adjustments of dependent variables to be identical for the changes in the past values of all independent variables. As Magee (1975) argues, there is, however, no reason to believe that a dependent variable responds in an identical way to changes in independent variables.

A number of studies have concluded that the lag responses of imports and exports are likely to be quite different depending on the explanatory variable which causes the response. A model that allows different time periods in which a dependent variable responds to changes in independent variables is the polynomial distributed-lag specification. Further, this model assumes that the weights of lagged-terms follow a polynomial of a given degree. The polynomial distributed-lag model allows not only for the choice of an appropriate number of lags, but also for a degree of polynomial as well as beginning-end point restrictions. The selection of these features, however, remains to be determined simply by application of some statistical procedures. The polynomial distributed-lag model of the imports as a function of exchange rate, E, for instance, could be written as follows:

$$M_t = \alpha + \beta \sum_{i=0}^{m} W_i E_{t-i} + \varepsilon_t \qquad (i = 0, 1, 2, ..., m). \tag{17}$$

Also, distribution of the lag coefficients could be well approximated by

$$W_i = (\lambda_0 + \lambda_1 i^1 + \lambda_2 i^2 + \lambda_3 i^3 + ... + \lambda_p i^p) \tag{18}$$

where p is the degree of polynomial and m is the number of lags. To make each of the weights W_0, W_2,..., W_m lie along a fourth degree polynomial curve, then

$$W_i = \lambda_0 + \lambda_1 i^1 + \lambda_2 i^2 + \lambda_3 i^3 + \lambda_4 i^4 \tag{19}$$

By substituting (19) into (17), the polynomial lag becomes

$$M_t = \alpha + \beta[\lambda_0 E_t + (\lambda_0 + \lambda_1 + \lambda_2 + \lambda_3 + \lambda_4)E_{t-1} + (\lambda_0 + 2\lambda_1 + 4\lambda_2 + 9\lambda_3 + 16\lambda_4)E_{t-2} + ... + (\lambda_0 + m\lambda_1 + m^2\lambda_2 + m^3\lambda_3 + m^4\lambda_4)E_{t-m} + \varepsilon_t, \tag{20}$$

which could be simplified as

$$M_t = \alpha + \beta(\lambda_0 Z_{t0} + \lambda_1 Z_{t1} + ... + \lambda_4 Z_{t4}) + \varepsilon_t \tag{21}$$

where

$$Z_{t0} = E_t + E_{t-1} + ... + E_{t-m},$$

$Z_{t1} = E_{t-1} + 2E_{t-2} + ... + mE_{t-m}$,

.

.

$Z_{t4} = E_{t-1} + 2^4E_{t-2} + ... + m^4E_{t-m}$.

To deal with the estimation of lag length and degree of polynomial, most studies assume a second degree polynomial with head and tail point restrictions.[12] In this study, unlike other studies, the number of lags and the degree of polynomial are not restricted to an assumed number. A two-step procedure is adopted in order to deal with the determination of the lag length and the degree of polynomial:[13]

First, to test for the length of lag, the estimation of each equation is started with the maximum possible number of lags of each independent variable without any constraint imposed on the lag distributions. For instance, for the import price equation, contemporaneous values of the exchange rate and industrial countries' wholesale price variables plus eight (m^*) and four (n^*) lagged-terms of each independent variable, respectively, are incorporated into the equation. When the estimated coefficients of the far-end lags are found insignificant, these terms are dropped from the equation and the estimation is continued with m^*-1 and n^*-1 lagged-terms on the right-hand side. The process of estimation is continued until no more insignificant far-end coefficients emerge. In addition, to choose among similar results, the sign and significance level of the coefficients of the independent variables, as well as the goodness-of-fit, are taken into consideration.

Second, to determine an appropriate degree of polynomial, with the lag length determined in the previous step, estimation of (21) is begun with a fairly high degree of polynomial, say, p^* which could be equal to (m-1). The degree of polynomial is reduced by one whenever an insignificant coefficient is encountered for the highest degree polynomial, the far-end Z_t. The process is continued until the first significant coefficient is found.

2.5 The Effective Exchange Rate of the U.S. Dollar

A key issue in assessing the impact of changes in the dollar's value on the group countries' trade flows and, consequently, on their merchandise trade balances, is to determine which measure of dollar exchange rate to employ. The choice of a specific measure of the exchange rate of the dollar should be motivated by the nature of the trade flows being investigated. In examining the effect of changes in the exchange rate of the dollar on a bilateral trade between the U.S. and Germany, for instance, the most appropriate measure of the dollar would be its price relative to the Deutsche mark. However, when

---

[12] Deyak et. al. (1990) assume a second degree polynomial with an end point restriction. The far-end zero constraint was imposed on the assumption that the economic impact of lags would at some point reach zero. Kmenta (1971) and Johnston (1984), however, do not recommend the use of end-point restriction on the grounds that the regression model gives no information about the behavior of the lag variables outside the model.

[13] The joint estimation of the lag length and degree of polynomial is a problematic matter and it is not fully resolved in the literature.

analyzing the impact of changes in the exchange rate in a multilateral trade framework, no single bilateral exchange rate could adequately reflect changes in the dollar's value. In effect, the dollar may change in varying degrees against any number of individual floating currencies. Thus, a weighted average of all the bilateral changes, effective exchange rate, is required to reflect the true change in the exchange value of the dollar. Several possible weights can be used in calculating the average and, correspondingly, each currency can have several effective exchange rates.[14]

Studies dealing with dollar exchange rate indexes, such as Pauls (1987) and Anderson et. al. (1987), suggest that no single measure of the weighted-average exchange rate index is appropriate for the trade flow analysis under different circumstances of commodity groups or trading partner countries.

The weight assigned to each foreign currency in an index should reflect the importance of that currency with respect to the economic problem being analyzed, Magee and Rao (1980). Therefore, for investigating the degree of exchange rate pass-through, an invoicing-currency-weighted exchange rate index should be used. Such an index explicitly accounts for the invoicing currency of trade and allows us to obtain a better estimate of the degree of exchange rate pass-through. Unfortunately, however, lack of sufficient information on the invoicing currency of trade has made it impossible to construct such an index. In the past, researchers have relied on trade-weighted exchange rate indexes instead. In this study, we examined a few effective exchange rate indexes and we found that the Federal Reserve Board's trade-weighted-average index of dollar value outperforms the others. For details on this index, see Appendix B.

3. Summary of Empirical Results

This section presents the major empirical results. Table 4 is a list of estimates of the long-run exchange rate elasticity of import prices. Columns 1, 2, and 3 display the estimates obtained from regressions over the entire period, the Bretton Woods, and post-Bretton Woods periods, respectively.

Estimates of the long-run exchange rate elasticity of import-price are all negative and, except for Saudi's import-price over the Bretton Woods period, statistically significant. The elasticity estimates range from -0.53 to -0.82 and are settled around -0.75. The time period in which import prices respond to changes in exchange rates differs between the fixed and flexible rate regimes. During 1960:I-71:III, import prices responded to changes in exchange rate of the dollar almost immediately, while for the 1971:IV-86:III period, such a response takes place within four quarters. The relatively sluggish response of the import price during the floating rate system could be mainly attributed to the uncertainty involved with the exchange rates, such that, at any given time, the next movement of the

---

[14] To mention only a few, the Federal Reserve Board (FRB), the Morgan Guaranty Trust Company (MG), and the International Monetary Fund (IMF) construct somewhat different indexes of the effective exchange rate of the dollar. The path in which any dollar index moves could be significantly affected by the choice of currencies included, weights applied to each currency, and by accounting for inflation. For instance, between 1980:III and 1985:I, the FRB's measure of the dollar appreciated by more than 83 percent. At the same time, the Federal Reserve Bank of Cleveland's (FRBC) measure rose as just over 78 percent. However, from 1985:I to 1986:III, while the FRB index depreciated by about 31 percent, the FRBC index showed that the dollar depreciated by only 9 percent, and that depreciation offset considerably much less of the dollar's previous appreciation.

exchange rate was unpredictable for traders.

Table 5 illustrates the estimates of the long-run exchange rate elasticities of export prices. Except for Saudi Arabia, estimates of the long-run exchange rate elasticity of export-price are also negative and statistically significant. Saudi Arabia's export-prices remain unresponsive to changes in the exchange rate for all of the time periods of estimation. The exchange-rate elasticity results could be highlighted in different words. Table 6, which is generated from Tables 4 and 5, shows the exchange rate pass-through figures for the post-Bretton Woods period. During the post-Bretton Woods period a 10 percent depreciation of the dollar, for instance, would have caused import prices expressed in dollars to rise by 7.6 to 7.8 percent in the group countries, leaving a 2.4 to 2.2 percent export price cut to be borne by exporters who invoice in terms of currencies other than the U.S. dollar. In contrast, the same amount of depreciation of dollar leads to a 2.5 to 2.2 percent rise in the export prices of Iran and Venezuela, and zero percent in Saudi Arabia.

In general, statistical results support a partial exchange rate pass-through to the group countries' import prices of 76-78 percent. With regard to the export prices, however, a distinction should be made among importing countries because of their domestic currencies. For the United States, for instance, a rise in its import prices from Iran, Venezuela, and Saudi Arabia following a 10 percent depreciation of the dollar would be 2.5, 2.2, and 0 percent, respectively. For countries other than the U.S., on the other hand, the change in their import prices would be 10 percent less than the figures for the U.S. of -7.5, -7.8, and -10 percent. The figures for Saudi Arabia imply that since this country's export price does not respond to changes in the exchange rate of the dollar, the domestic currency price of imports for countries other than the U.S. falls as much as the depreciation of the dollar. Clearly, the pass-through of depreciation of dollar to export prices is still partial as Iran and Venezuela adjust their prices up by only 2.5 and 2.2 percent, respectively. Whether this response is the result of rising marginal cost of production caused by higher import input prices for the oil industry in these countries or by mark-up adjustment is not known from our results. But clearly, the magnitude of export price responses is considerably less than necessary to keep these countries' export prices constant in terms of international purchasing power.

The way in which export prices adjust fully to changes in the exchange rate of the dollar is quite similar to the adjustment pattern of import prices--except for Saudi Arabia whose export price remains insensitive to changes in the exchange rate of the dollar. This result, however, may be interpreted as Saudi Arabia's strategy toward absorbing fluctuations in the exchange rate of the dollar, what came to be known as this country’s price moderation to maintain a greater market share than other crude exporters.

Table 7 and 8 illustrate estimates of the long-run price elasticities of demand for imports and exports. In general, unlike the results obtained from the estimation of imports and exports price equations, the results of demand equations are less satisfactory, as 50 percent of the estimates are insignificant and some with unexpected signs. One could, however, easily distinguish the cross-country differences in the long-run price elasticities of demand for imports and exports. The sum of the long-run price elasticities of demand for imports and exports exceeds unity for Iran only, for the post-Breton Woods and entire periods. The short run elasticities, not shown here, are all smaller than the long-run elasticities, a result which is consistent with those of previous studies.[15] Export demand equations from Iran and Venezuela estimated over most of the time periods display the expected negative signs; in particular, they are significant for the entire period (Table 8). In contrast, the estimates of the long-run price elasticity of demand for Saudi's exports are significant with positive signs over all of the time periods. Overall, our results suggest that the group countries, like many other developing countries, are heavily dependent upon imports so that their price elasticities of demand tend to be low, giving support to the so called ‘elasticity pessimism’ view of devaluation.

Estimates of the exchange rate elasticities of import and export prices as well as of price elasticities of import and export demands can be used together to show the magnitude of adjustment and time it takes for the trade balances to adjust in response to changes in the exchange rate. In doing so, first the sign, magnitude, and duration of the impact of changes in the exchange rate of the dollar on import and export prices are considered; second, the induced quantity responses are taken into account.

During the Bretton Woods period, quantities of imports and exports by Iran and Venezuela remained unresponsive to changes in relative prices; therefore, changes in import prices remain responsible for the adjustment of the nominal trade balances. In this period, depreciations of the U.S. dollar have caused trade balances of Iran and Venezuela to decline almost immediately through higher prices of imports, while they exerted no impact on Saudi Arabia's trade balance. However, during the post-Bretton Woods era, Iran seems to be the only country whose import and export prices, as well as quantities, were instrumental in transmitting the influence of the exchange rate to the trade balance. That is, this country's trade balance deteriorates initially up to 4 quarters after depreciation of the dollar and improves thereafter. For Venezuela, the initial deterioration takes a longer time (6 quarters) and, more importantly, the trade balance does not improve after the initial decline as quantities do not respond to changes in price. Saudi Arabia's trade balance adjusts in a way similar to that of Venezuela’s. The trade balance declines initially (up to 4 quarters) because of higher import prices; yet, it fails to improve as the quantity of imports does not respond to changes in price. In sum, while changes in the exchange rate of the dollar do influence these countries' trade balances in terms of U.S. dollars, the balances follow different adjustment patterns and time profiles. In addition, each country's trade balance follows different adjustment patterns under the fixed and flexible exchange rate regimes. Specifically, this study suggests a mixed result in which the J-curve effect was observed in one out of the three countries, Iran. The results are consistent with those of other studies in the literature. Edwards (1989) surveys the effects of thirty-nine ‘cases of devaluations’ carried out by developing countries in the 1960's through the 1980's on the current account, output and other variables. The study suggests that, in 41 percent of the cases, a devaluation reduced the current account balance in the first year after devaluation and, in many of these cases, it did improve the trade balances after three years had elapsed. Goldstein and Khan’s (1985) survey of the literature provides evidence of the effectiveness of exchange rate changes

[15] Goldstein and Kahn (1985) in a survey of the empirical literature of the trade flow of a number of developed nations suggest that, in general, long-run elasticities (greater than two years) are approximately twice as much as short-run elasticities (0-6 months). Furthermore, the short-run elasticities generally fail to sum to unity while the long-run elasticities almost always sum to greater than unity.

while the degree of effectiveness varies across nations.

Estimates of real income elasticities of demand for imports and exports as a measure of real income linkages are illustrated in Tables 9 and 10. The estimates reveal expected (positive) signs and most of them are statistically significant. Real income elasticities during the post-Bretton Woods period are greater than the corresponding figures in the Bretton Woods period. For Saudi Arabia, for instance, real income elasticities of demand for imports were 1.06 and 2.14 for the Bretton Woods and post-Bretton Woods periods, respectively. This differential suggests that during the post-Bretton Woods period, the shares of increases in real income spent on imports were greater than those in the previous period. In other words, over time, as economies grow, they become more interdependent.

During the post-Bretton Woods period, except for Iran, the group countries' real income elasticities of demand for imports are greater than elasticities of demand for exports from these countries, see column 3 Tables 9 and 10. That is, the proportion of income growth spent by the group countries on imports of manufactured and semi-manufactured commodities from industrial countries is greater than the corresponding figure spent by the industrial countries. The elasticity figures, taken as measure of interdependency, imply that, over time, the group countries have become relatively more dependent on imports from industrial countries than have industrial countries for imports of oil from the group countries.

Estimates of the long-run import-price elasticity of the industrial countries' wholesale prices are illustrated in Table 11. The elasticity of import-price with respect to industrial countries' wholesale prices is almost unity. This feature is robust across the group countries and over all of the time periods. That is, over a period not exceeding two quarters, the group countries' import prices rise virtually as much as the industrial countries' wholesale prices do. Hence, depending upon the share of imports in the group countries' GDP, a rise in the industrial countries' wholesale prices leads to inflation in the group countries. Given that during the1970's and 1980's the ratio of the oil-exporting countries' imports to GDP was around 20 percent, a 5 percent increase in the industrial countries' wholesale prices would have resulted in a 1 percent rise in the group countries' price level.

Table 12 illustrates the estimates of the long-run export-price elasticities with respect to the group countries' wholesale prices. All of the estimates carry positive signs and they are statistically significant. The results suggest that the export prices of the group countries are, in the long run, reflective of changes in domestic wholesale prices of these countries. Although the latter result should be interpreted with caution, it is justifiable to suggest that price levels in trading countries are linked to each other. In other words, for open economies, inflation in each country can be a domestic or global phenomenon.

4. Conclusion

The present study examines the effects of changes in the exchange rate of the U.S. dollar on the merchandise trade balances of three oil exporting countries, Iran, Venezuela, and Saudi Arabia. By adapting an exchange rate pass-through model, both price and quantity equations of traded goods of these nations are estimated. Quarterly data are utilized for the period of 1960 through the 1980's. The model allows changes in the exchange rate of the dollar to affect the price of traded goods, and changes in price to influence the quantity of imports and exports. The model is estimated over the fixed and floating exchange rate periods. The study suggests that:

1) Changes in the effective exchange rate of the dollar pass partially to these countries' import prices. For instance, a 10 percent depreciation of the dollar during the post Bretton Woods period caused import prices expressed in dollars to rise by 7-8 percent, leaving 2-3 percent to be borne by exporters of non-dollar denominated commodities.

2) During the fixed rate period, export prices of these countries remained unaffected by infrequent but major realignment of exchange rates. In contrast, under the floating rate system, a 10 percent depreciation of the dollar, for instance, caused export prices of Iran and Venezuela to rise by 2.5 and 2.2 percent, respectively. During this period, Saudi Arabia's export price, however, remained as stable as it was during the fixed rate period. Clearly, the export price elasticity figures indicate that Iran and Venezuela have increased their prices to partially offset the decline in the value of the US dollar. Consequently, industrial countries have shifted their demand away from Iran and Venezuela in favor of Saudi Arabia whenever there has been a rise in the price of oil. With regard to these countries' export price strategies, the results indicate that Iran and Venezuela are primarily price maximizers, while Saudi Arabia is concerned more with its market share, an outcome consistent with the "absence of a unified OPEC policy" view.

3) Overall, price elasticities of demand for imports are very low. This indicates that the group countries, like many other developing countries, are heavily dependent upon imports. This observation gives support to the so called ‘elasticity pessimism’ view of devaluation.

4) While changes in the exchange rate of the dollar do influence these countries' trade balances, each country's trade balance follows a different adjustment pattern. Specifically, the study suggests the J-curve effect for one country out of three (Iran). Furthermore, responses of trade balances to changes in the exchange rate are not the same under the fixed and flexible exchange rate regimes.

5) The estimates of the real-income elasticities of demand for imports and exports are all significant with the expected signs. The estimates indicate the real-income linkages and the magnitudes by which shocks to income in one nation can affect the trade partner nation’s trade balance.

6) The estimates of the long-run import and export price elasticities with respect to domestic price levels support the existence of an automatic price adjustment mechanism between the trading nations.

References

Ahluwalia, Isher J. and Hernandez-Cata E., "An Econometric Model of U.S. Merchandise Imports Under Fixed and Fluctuating Exchange Rates," *Staff Papers*, IMF, November 1975, No. 22, pp. 791-824.

Anderson, Gerald H., Karamouzis Nicholas V., and Skaperdas, Peter D., "A New Effective Exchange rate Index for the Dollar and its Implications for U.S. Merchandise Trade," *Economic Review*, Federal Reserve Bank of Cleveland, Quarter 2, 1987, pp. 2-23.

Augustine, Arize and Afifi, Rasoul, "An Econometric Examination of Import Demand Function in Thirty Developing Countries," *Journal of Post Keynesian Economics,* Vol. 1X, No. 4, Summer 1987, pp. 604-616.

Bahmani-Oshooee, Mohsen, "Determinants of International Trade Flows: The Case of Developing Countries," *Journal of Developments Economics*, Vol. 20, 1986, pp. 107-123.

Bahmani-Oskooee, Mohsen, "Devaluation and the J-Curve: Some Evidence from LDCs," *The Review of Economics and Statistics*, Vol. 67, November 1984, pp. 500-504.

Baldwin, R., "Hysteresis in Import Prices: the Beachhead Effect," *American Economic Review*, 78, 1988, pp. 773-785.

Basevi, Giorgio, Cocchi, Daniela, and Lischi, Pier Luigi, "The Choice of Currency in the Foreign Trade of Italy," in Hodgman, Donald R. and Wood, Geoffrey E. (eds.), *Monetary and Exchange Rate Policy*, The MacMillan Press LTD, 1987.

Carse, Stephen and Wood, Geoffery E., "Currency of Invoicing and Forward Covering," in Martin, Johan P. and Alasdair, Smith (eds.), *Trade and Payments Adjustment Under Flexible Exchange Rates*, London, Trade Policy Research Center, 1979, pp. 174-198.

Chow, Gregory C. and Lin, An-Loh, "Best Linear Unbiased Estimation of Missing Observations in an Economic Time Series," *Journal of the American Statistical Association*, Vol. 71, No. 355, September 1976, pp. 719-721.

Deppler, Michael C., "Some Evidence on the Effect of Exchange Rate Changes on Trade," *Staff Papers*, IMF, No. 21, November 1977, pp. 605-636.

Deyak Timothy A., Sawyer Charles W., and Sprinkle Richard L., "The Effects of Exchange Rate Changes on Prices and Quantities in U.S. Foreign Trade," *The International Trade Journal*, Vol. 5, No. 1, Fall 1990, pp. 77-92.

Deyak Timothy A., Sawyer Charles W., and Sprinkle Richard L., "An Empirical Examination of the Structural Stability of Disaggregated U.S. Import Demand," *The Review of Economics and Statistics*, Vol. 71, 1989, pp. 337-341.

Edwards, Sebastian, *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries*, The MIT Press, 1989.

Feinberg, Robert M., "The Effects of Foreign Exchange Movements on U.S. Domestic Prices," *Review of Economics and Statistics*, Vol. 71, 1989, pp. 505-510.

Fisher, Eric O'N., "A Model of Exchange Rate Pass-Through," *International Finance Discussion*

Papers, Board of Governors of the Federal Reserve System, No. 302, February 1987.
Froot, Kenneth A. and Klemperer, Paul D. , "Exchange Rate Pass-Through When Market Share Matters," *American Economic Review*, Vol. 79, 1989, pp. 637-654.
Gagnon, J., Knetter M., "Pricing to Market in International Trade: Evidence From Panel data on Automobiles and Total Merchandise,"*International Finance Discussion Papers*," Board of Governors of the Federal Reserve System, No. 389, October 1990.
Ghoshal, Animesh and Snyder, James, W., "Flexible Exchange Rate and International Trade: An Empirical Investigation of Bilateral Trade Flows," *The International Trade Journal*, Vol. 1, 1986, pp. 27-46.
Goldstein, Morris and Khan, Mohsin, "The Supply and Demand for Exports: A Simultaneous Approach," *The Review of Economics and Statistics*, Vol. 60, May 1976, pp. 275-286.
Goldstein, Morris, and Khan, Mohsin, "Income and Price Effects in Foreign Trade," in Jones, R.W. and Kenen, P.B. (eds.), *Handbook of International Economics*, Vol. 2, Elsevier Science Publishers B. V., 1985, pp. 1041-1105.
Gotur, Padma, "Effects of Exchange Rate Volatility on Trade," *Staff Papers*, IMF, Vol. 32, September 1985, pp. 475-512.
Grassman, Sven, "A Fundamental Symmetry in International Payment Patterns," *Journal of International Economics*, May 1973, pp. 105-116.
Grassman, Sven, "Currency Distribution and Forward Cover in Foreign Trade: Sweden Revisited," *Journal of International Economics*, May 1976, pp. 215-222.
Haynes, Stephen E. and Stone, Joe A., "Specification of Supply Behavior in International Trade,"
The Review of Economics and Statistics, Vol. 65, 1983b, pp. 626-631.
Haynes, Stephen E., Hutchinson, Michael M., and Mikessell, Raymond F., "U.S.-Japanese Bilateral Trade and the Yen-Dollar Exchange rate: An Empirical Analysis," *Southern Economic Journal*, Vol. 52, 1986, pp. 923-932.
Helkie, William L. and Hooper, Peter, "The U.S. External Deficit in the 1980s: An Empirical Analysis," *International Finance Discussion Papers*, Board of Governors of the Federal Reserve System, No. 304, February 1987.
Himarios, D., "The Effects of Devaluation on the Trade Balance: A Critical View and Re-examination of Miles's New Results," *Journal of International Money and Finance*, December 1985, No. 4, pp. 553-563.
Hooper, Peter and Mann, Catherine L., "Exchange Rate Pass-through in the 1980s: The Case of U.S. Imports of Manufactures," *Brookings Papers on Economic Activity*, 1:1989, pp. 297-337.
Hooper, Peter and Kohlhagen, Steven W., "The Effect of Exchange Rate Uncertainty on the Prices and Volume of International Trade," *Journal of International Economics*, January 1978, pp. 485-511.
Johnston, John, *Econometric Methods*, New York: McGraw-Hill, 1984.
Kenen, Peter B. and Dani Rodrik, "Measuring and Analyzing the Effects of Short-Term Volatility in Rate Exchange Rates," *The Review of Economics and Statistics*, Vol. 68, May 1986, pp. 311-315.
Khan, Mohsin S. and Knight, Malcolm D., "Import Compression and Export Performance in

Developing Countries," *The Review of Economics and Statistics*, October 1987, pp. 315-321.
Kmenta, Jan, *Elements of Econometrics*, New York: Macmillan publishing Co., Inc., 1971.
Knetter, M., "Price Discrimination by U.S. and German Exporters," *American Economic Review*, 79, 1989, pp. 198-210.
Koch, Paul D. and Rosenswieg, Jeffrey A., "The U.S. Dollar and the Delayed J-Curve," *Economic Review*, Federal Reserve Bank of Atlanta, July-August 1988, pp. 2-15.
Koch, Paul D. and Rosenswieg, Jeffrey A., "The Dynamic Relationship Between the Dollar and Composition of U.S. Trade," *Journal of Business and Economic Statistics*, Vol. 8, No. 3, July 1990, pp. 355-364.
Kreinin, E. Mordechai, "The Effect of Exchange Rate Changes on the Prices and Volume of Foreign Trade," *Staff Papers*, IMF, Vol. 24, 1977, pp. 297-329.
Krugman, Paul R. and Baldwin, Richard E. "The Persistence of the U.S. Trade Deficit," *Brooking Papers on Economic Activity*, No. 1, 1987, pp. 1-55.
Krugman, Paul R., "Pricing to Market When the Exchange Rate Changes," in Arndt, S.W. and Richardson, J.D. (eds.), *Real-Financial Linkages Among Open Economies*, MIT Press, Cambridge, 1987, pp. 49-70.
Krugman, Paul, "Vehicle Currencies and the Structure of International Exchange," *Journal of Money, Credit and Banking*, XII, 3, August 1980, pp. 513-526.
Krugman, Paul, "The International Role of the Dollar: Theory and Prospect," in Bilson, John F.O. and Marston, Richard C. (eds.), *Exchange Rate Theory and Practice*, The University of Chicago Press, 1984, pp. 261-278.
Leuvensteijn, Michiel V., “An Analysis of the ECU as an Invoicing Currency in International trade in the Period 1983-1990,” *BNL Quarterly Review*, No. 188, March 1994, pp. 53-74.
Litterman, Robert B., "A Random Walk, Markov Model for the Distribution of Time Series," *Journal of Business and Economic Statistics*, Vol. 1, No. 2, April 1983, pp. 169-173.
Magee, Stephen P. and Rao, Ramesh K. S., "Vehicle and Non-Vehicle currencies in International Trade," *American Economic Review*, LXX, 2, May 1980, pp. 368-373.
Magee, Stephen P., "Currency Contracts, Pass-through and Devaluation," *Brooking Papers on Economic Activity*, 1:1973, pp. 303-325.
Magee, Stephen P., "U.S. Import Prices in the Currency-Contract Period," *Brookings Papers on Economic Activity*, 1:1974, pp. 117-167.
Mann, Catherine L., "Prices, Profit Margins and Exchange Rates," *Federal Reserve Bulletin*, No. 72, 1986, pp. 366-379.
Marquez, J., "Bilateral Trade Elasticities," *Review of Economics and Statistics*, 72, 1990, pp. 70-79.
Marquez, J. and McNeilly, C., "Income and Price Elasticities for Exports of Developing Countries," *Review of Economics and Statistics*, 70, 1988, pp. 306-314.
Marston, R., "Pricing to Market in Japanese Manufacturing," *Journal of International Economics*, 29, 1990, pp. 217-236.
McKinnon, Ronald I., *Money in International Exchange, The Convertible Currency System*, Oxford University Press, Inc. 1979.

Meade, Ellen E., "Exchange Rates, Adjustment, and the J-Curve," *Federal Reserve Bulletin*, October 1988, pp. 633-644.

Melvin, Michael and Sultan Jahangir, "The Choice of an Invoicing Currency in International Trade and the Balance of Trade Impact of Currency Depreciation," *Open Economies Review*, 1, 1990, pp. 251-268.

Miles, Marc A., "The Effects of Devaluation on the Trade Balance and the Balance of Payments: Some New Results," *Journal of Political Economy*, Vol. 87, June 1979, pp. 600-620.

Moffett, Michael H., "The J-Curve Revisited: An Empirical Examination for the United States," *Journal of International Money and Finance*, Vol. 8, 1989, pp. 425-444.

Murray, Tracy and Ginman, Peter, "An Empirical Examination of the Traditional Aggregate Import Demand Model," *The Review of Economics and Statistics*, Vol. 58, February 1976, pp. 75-80.

Page, S. A. B., "Currency of Invoicing in Merchandise Trade," *National Institute Economic Review*, London, No. 81, August 1977, pp. 77-81.

Page, S. A. B., "The Choice of Invoicing Currency In Merchandise Trade," *National Institute Economic Review*, London, No. 98, November 1981, pp. 60-72.

Pauls, Dianne B., "Measuring the Foreign-Exchange Value of the Dollar," *Federal Reserve Bulletin*, June 1987, pp. 411-422.

Ridler, Duncan and Yandle, Christopher A., "A Simplified Method for Analyzing the Effects of Exchange Rate Changes on Exports of a Primary Commodity," *Staff Papers*, IMF, Vol, 19 November 1972, pp. 559-578.

Spitaller, Erich, "Short-Run Effects of Exchange Rate Changes on Terms of Trade and Trade Balance," *Staff Papers*, IMF, 27, 2, June 1980, pp. 320-348.

Thursby, L. and Thursby, M., "How Reliable are Simple, Single Equation Specification of Import Demand?" *Review of Economics and Statistics*, 66, 1984, pp. 120-128.

Thursby, Jerry G., "A Test Strategy for Discriminating between Autocorrelation and Misspecification in Regression Analysis," *The Review of Economics and Statistics*, No. 63, February 1981, pp. 117-123.

Thursby, Jerry G., "Alternative Specification Error Tests: A Comparative Study," *Journal of the American Statistical Association*, No. 74, March 1979, pp. 222-225.

Warner, Dennis and Kreinin, Mordechai E., "Determinants of International Trade Flows," *The Review of Economics and Statistics*, Vol. 65, February 1983, pp. 96-104.

Wilson, John F. and Takacs, Wendy, "Expectations and the Adjustment of the Trade Flows Under Floating Exchange Rates: Leads, Lags, and the J-Curve," *International Finance Discussion Papers*, Board of Governors of the Federal Reserve System, No. 160, April 1980.

Yoonbai, Kim, "Exchange Rates and Import Prices in the United States: A Varying-Parameter Estimation of Exchange-Rate Pass-through," *Journal of Business and Economic Statistics*, Vol. 8, No. 3, July 1990, pp. 305-315.

Yousefi Asr, Ayoub, "The U.S. Dollar Exchange Value and Merchandise Trade Balances of Less Developed Countries: The Cases of Iran I.R.of, Venezuela, and Saudi Arabia" *Ph.D. Dissertation*, The University of Tennessee, Knoxville, USA, 1992.

Description and Sources of Data

Annual and quarterly data series for the 1960 through the 1980s were taken from the following sources:

International Financial Statistics, IMF, various monthly issues and the Yearbooks.
International Financial Statistics, Supplement on Trade Statistics, IMF, No. 4, 1982 and No. 15, 1988.
International Financial Statistics, Supplement on Exchange Rates, IMF, No. 1, 1981 and No. 9, 1985.
International Financial Statistics, Supplement on Price Statistics, IMF, No. 2, 1981 and No. 12, 1986.
International Financial Statistics, Direction of Trade Statistics, IMF, various issues.
Statistics of Foreign Trade, Organization for Economic Cooperation and Development (OECD), Series A, B and C.
International Trade Statistics, United Nations, Yearbooks.
Federal Reserve Bulletin, The Board of Governors of the Federal Reserve System, various issues.

ENDNOTE 1

For most developing countries, time series data for some variables such as real GDP, import unit value indexes, or wholesale prices are either not available on quarterly basis or they are discontinued. Quarterly data series utilized in this study were generated from annual data series by applying "PROC EXPAND PROCEDURE," SAS/ETS User's Guide, Version 6, First Edition, 1988. The expand procedure converts time series from one sampling interval or frequency to another, from higher frequency to lower one and vis-a-versa. By default, the procedure fits cubic spline curves to the non-missing values of variables to form continuous-time approximations of the input series. Output series are then generated from the spline approximations.

ENDNOTE 2

Unit value indexes do not represent actual transaction prices but an estimated average value per physical unit of a commodity category at the time of delivery. The unit value index should be interpreted with caution since a change in the unit value index generally involves an unknown combination of price change, variation in the commodity mix as well as changes in exchange rate. Also, because of order-delivery lags and the fact that some contracts are invoiced in foreign currencies, the import or export unit values represent a combination of present and past contract prices (determined by unit labor cost, unit material cost, and the markup factor at the exporting country), and the exchange rate. Clearly, measurement error inherent in the unit value index may render the statistical results less reliable. Nonetheless, faced with lack of actual transactions prices like many other researches, we adopt unit value indexes.

Unit value indexes are obtained from *International Financial Statistics, Supplement on Trade Statistics*, IMF. The methods used in their construction are explained as follows:

"The data for the *Export and Import Unit Value Indexes* table are obtained from national sources. For some countries, indexes are compiled according to the Laspeyres formula with trade values for a particular year as weights. For others, they are derived from the ratio of a value index and a Laspeyres volume index resulting in a Paasche index. Other indexes are compiled using unit values for major export commodities derived from country value and volume data from IFS"

Appendix A

We generalize a static trade-balance identity in order to account for the currency invoicing of trade contracts:

$$TB^d = [P_x^d Q_x^d + P_x^{\$} Q_x^{\$} e^{\$} + P_x^o Q_x^o e^o] - [P_m^d Q_m^d + P_m^{\$} Q_m^{\$} e^{\$} + P_m^o Q_m^o e^o] \qquad \text{(A-1)}$$

where TB^d is the merchandise trade balance in terms of domestic currency, P_x^d, $P_x^{\$}$, P_x^o are the export unit price denominated in terms of domestic currency, the U.S. dollar, and a weighted average of other currencies except the U.S. dollar, respectively, P_m^d, $P_m^{\$}$, P_m^o are the import unit price with denominations as in the exports, $Q_x = Q_x^d + Q_x^{\$} + Q_x^o$ is the corresponding volume of exports, $Q_m = Q_m^d + Q_m^{\$} + Q_m^o$ is the corresponding volume of imports, $e^{\$}$ is the domestic currency units per U.S. dollar, and e^o is the domestic currency units per weighted-average of major currencies, excluding the U.S. dollar.

As pointed out earlier, the group countries' currencies play almost no role in settling international contractual obligations. The countries therefore are strictly constrained for foreign payments by their receipts from exports. Moreover, the group countries' exports are almost entirely invoiced in dollars, no matter where the export commodities are destined, while their imports could, conceivably, be settled in terms of almost any convertible currency. Therefore, it is reasonable to set Q_x^d, Q_m^d, and Q_x^o equal to zero. Hence, (A-1) simplifies to

$$TB^d = P_x^{\$} Q_x^{\$} e^{\$} - [P_m^{\$} Q_m^{\$} e^{\$} + P_m^o Q_m^o e^o]. \qquad \text{(A-2)}$$

From (A-2), changes in the exchange rate of the U.S. dollar affect TB^d directly through $e^{\$}$ and indirectly through e^o. That is, variations in the TB^d depend, among other things, on the extent to which the value of the U.S. dollar changes against other major currencies. For instance, when the dollar depreciates against domestic currencies of the group countries, other major currencies may depreciate, gain value, or remain unchanged against these currencies; i.e., $\Delta e^{\$} < 0$, may be associated with $\Delta e^o < 0$, $\Delta e^o > 0$, or $\Delta e^o = 0$. Therefore, the merchandise trade balance in terms of domestic currency can change in any direction following dollar fluctuations. This implies that the direction of change in TB^d in response to changes in the dollar's value is ambiguous. In other words, a model of trade balance in terms of domestic currency such as (A-2), which includes different exchange rates of the domestic currency, is inappropriate for analyzing the impact of changes in the exchange rate of the dollar on these countries' trade balances. The problem with TB^d, however, could be resolved when TB is written in terms of dollars

$$TB^{\$} = P_x^{\$} Q_x^{\$} - [P_m^{\$} Q_m^{\$} + P_m^{o} Q_m^{o} E] \qquad \text{(A-3)}$$

where $TB^{\$}$ is the merchandise trade balance in terms of U.S. dollars, and E is the units of the U.S. dollar per weighted average index of other major currencies. When the trade balance and exchange rate are defined in terms of dollars, depreciation of the dollar, $\Delta E > 0$, is clearly expected to lead to deterioration of the trade balance, while appreciation does the opposite. Therefore this study utilizes the dollar exchange rate and excludes the domestic currency exchange rate of the group countries from the model. Unlike other studies, however, the model is structured based on explicit imports and exports demand and supply functions. For non-structural techniques which directly model the trade balance as a function of the real exchange rate and domestic and foreign scale variables see Rose and Yellen (1998) and Rose (1990).

Appendix B

The Federal Reserve Board's index of the weighted-average exchange value of the U.S. dollar is an index of the average exchange value of the dollar that summarizes in one number the various individual exchange rates of the dollar against currencies of the G-10 countries. The weight for each of the 10 currencies is the 1972-76 average world trade of that country divided by the average world trade of all 10 countries combined. The base period of the index is march 1973, the beginning of the period of generalized floating exchange rates system. The formula used to calculate the value of the index at time *t* is defined as follows

$$100 \exp \sum_{i=0}^{10} W_i \, \text{Log}_e R_{it}$$

where R_{it} is the based period exchange rate of currency i divided by exchange rate of currency i at time t, with all exchange rates expressed in U.S. cents per unit of foreign currency and W_i is the weight for currency i. The base period exchange rates and weights are as follows:

Currency-Country	Exchange Rate	Weight
Germany/Deutsche mark	35.548	0.208
Japan/yen	0.3819	0.136
France/franc	22.191	0.131
United Kingdom/pound	247.24	0.119
Canada/dollar	100.33	0.091
Italy/lira	0.176	0.090

Netherlands/guilder	34.834	0.083
Belgium/franc	2.5377	0.064
Sweden/krona	22.582	0.042
Switzerland/franc	31.084	0.036
Sum		1.000

Table 1. Currencies Used in World Trade (Percent)

Country (Region)	Year	Share of Each Country's Exports in				Share of Each Country's Imports in			
		Dollars (1)	DM (2)	Sterling (3)	Own (4)	Dollars (5)	DM (6)	Sterling (7)	Own (8)
Canada	E	85.0	0.2	1.0		95.0	1.0	2.0	
France	1979	11.6	10.2	3.2	62.4	28.7	14.1	3.8	35.8
Germany	1980	7.2	82.3	1.5	82.3	33.1	42.8	3.1	42.8
United Kingdom	1979	17.0	3.0	76.0	76.0	29.0	9.0	38.0	38.0
United States	E	98.0	1.0	1.0	98.0	85.0	4.1	1.5	85.0
Japan	1980	61.5	1.9	0.9	32.7	93.0	2.0	2.0	2.0
Oil Exporters	E	100.0	0.0	0.0		50.0	10.0	8.0	4.0
Other Developing	E	85.0	0.0	15.0		72.0	7.0	4.0	
Non-OECD	E	85.0	2.0	7.0		52.0	14.0	9.0	
Developed World (1979Weights)		54.8	14.4	7.5		54.3	13.9	6.9	

E: Estimate
Reproduced from: Page (1981)

Table 2. International use of Currencies
(Percent, 1979 Weights)

	Country's Share in World Exports	Currency's Share in Exports	Cumulative Share of Currencies
Dollar	11.7	54.8	54.8
Deutsche mark	11.1	14.4	69.2
Pound sterling	5.9	7.5	76.7
French franc	6.3	6.4(a)	83.1
Netherlands gui	4.1	3.0(a)	86.1
Belgian franc	3.6	2.6(a)	88.7
Yen	6.6	2.3(a)	91.0
Swiss franc	1.7	2.1(a)	93.1
Lira	4.7	1.9(a)	95.0
Swedish krona	1.8	1.7(a)	96.7
Schilling	1.0	0.8(a)	97.5
Danish krone	0.9	0.8(a)	98.3
Irish pound	0.5	0.3(a)	98.6
Finnish markka	0.7	0.0(a)	98.6

Reproduces from: Page (1981)
(a): use in own trade.

Table 3. Currency of Trade Invoicing in Six Major Industrial Countries[1] (Percent)

	Exports		Imports	
Country	National Currency	Other	National Currency	Other
France	58.5	41.0	48.9	49.8
Germany	81.5	18.0	52.6	44.9
Italy	38.0	62.0	27.0	73.0
Japan	34.3	65.7	14.1	89.6
United Kingdom	57.0	43.0	40.0	58.0
United States	96.0	3.0	85.0	12.0

Reproduced from: Tavlas and Ozeki (1991).

1) Data for German exports and Italian exports and imports are for 1987.

Table 4. Estimates of the long-run Exchange Rate Elasticities of Import Prices

$$\text{Ln PM}_t = \text{"}_0 + \sum_{i=0}^{m1} a_{1i}\,\text{Ln PFM}_{t-i} + \sum_{i=o}^{n1} a_{2i}\,\text{Ln E}_{t-i} + \mu_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	-0.82* (-29.63) (60: I-86:III)	-0.53* (-3.86) (60:I-71:III)	-0.78* (-18.87) (71:IV-86:III)
Venezuela	-0.80* (-23.61) (60: I-86:III)	-0.75* (-4.90) (60.I-71:III)	-0.76* (-18.11) (71:IV-86:III)
Saudi Arabia	-0.74* (-15.46) (60:I-86:III)	-0.163 (-0.727) (60:I-71:III)	-0.76* (-13.20) (71:IV-86:III)

- * : significant at the 5 percent level; t-statistics are in parentheses.
- Dummy variables for the fixed-floating exchange rate regimes and the oil shocks of 1973-74 and1979-80 are incorporated to test for the stability of the intercept parameters.
- The sum of the estimates of the contemporaneous and lagged coefficients of each variable is interpreted as the long-run elasticity estimate.
- Exchange rate is the index of trade weighted-average value of the US dollar against currencies of other G-10 countries plus Switzerland (March 1973=100)
- The 'RESET' test is applied to detect omitted relevant explanatory variable and incorrect specification of the regression equation.
- The Durbin-Watson statistic is utilized to test for AR(1), and the Yule-Walker estimation technique is used whenever serial correlations are detected.

Table 5. Estimates of the long-run Exchange Rate Elasticities of Export Prices

$$\text{Ln PX}_t = *_0 + \sum_{i=0}^{m2} d_{1i} \text{ Ln PDM}_{t-i} + \sum_{i=0}^{n2} d_{2i} \text{ Ln E}_{t-i} + <_t$$

	Entire Period	Post B-W Period
Iran	-0.270* (-6.00) (60: I-85:IV)	-0.250* (-4.54) (71:IV-85:IV)
Venezuela	-0.317* (-9.38) (60: I-86:III)	-0.219* (-5.91) (71:IV-86:III)
Saudi Arabia	-0.04 (-0.10) (63:I-85: IV)	0.14 (0.27) (71:IV-85:IV)

Table 6. Percentage Change in Import and Export Prices from a 10 percent Depreciation of the Dollar

	Import Price Measured in:		Export Price Measured in:	
Country	Dollar	Other Currencies	Dollar	Other Currencies
Iran	+7.8	-2.2	+2.5	-7.5
Venezuela	+7.6	-2.4	+2.2	-7.8
Saudi Arabia	+7.6	-2.4	0	-10

Table 7. Estimates of the long-run Price Elasticity of Demand for Imports

$$\mathrm{LnM}^d_t = \beta_0 + \beta_1 \,\mathrm{Ln}\, Y_t + \sum_{i=0}^{m1} b_{2i} \,\mathrm{Ln\, PM}_{t-i} + \sum_{i=0}^{m2} b_{3i} \,\mathrm{Ln\, PDM}_{t-i} + \varepsilon_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	-0.58 (-1.69) (61:II-86:I)	-1.23 (-0.48) (60:III-71:III)	-1.29* (-2.25) (73:I-86:I)
Venezuela	-0.56* (-2.00) (61:II-86:III)	-0.78 (-0.68) (61:II-71:III)	-0.58 (-1.50) (73:I-86:III)
Saudi Arabia	-0.004 (-0.014) (68:I-86:II)	-5.15* (-4.07) (68:I-71:III)	-0.54 (-1.84) (73:I-86:III)

Table 8. Estimates of the long-run Price Elasticity of Demand of Exports

$$\text{LnX}^{d}_{t} = \beta_0 + \beta_1 \text{ Ln } W_t + \sum_{i=0}^{n1} \gamma_{2i} \text{ Ln } PX_{t-i} + \sum_{i=0}^{n2} \gamma_{3i} \text{ Ln } PFM_{t-i} + \varepsilon_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	-1.58* (-3.96) (62:I-83:IV)	0.288 (0.364) (62:I-71:III)	-0.87* (-2.29) (73:I-83:IV)
Venezuela	-0.20* (-2.84) (62:I-83:IV)	-0.209 (-1.23) (62:I-71:III)	-0.124 (-1.015) (73:III-83:IV)
Saudi Arabia	0.85* (7.39) (62:I-83:IV)	1.68* (3.54) (62:I-71:III)	1.00* (7.00) (71:IV-83:IV)

Table 9. Real Income Elasticities of Demand for Imports

$$LnM^d_t = \beta_0 + \beta_1 \, Ln\, Y_t + \sum_{i=0}^{m1} \beta_{2i} \, Ln\, PM_{t-i} + \sum_{i=0}^{m2} \beta_{3i} \, Ln\, PDM_{t-i} + \varepsilon_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	1.16* (8.87) (61:II-86:I)	1.05* (2.80) (60:III-71:III)	1.67* (3.22) (73:I-86:I)
Venezuela	1.274* (3.94) (61:II-86:III)	3.57* (3.47) (61:II-71:III)	4.49* (6.61) (73:I-86:III)
Saudi Arabia	0.92* (3.99) (68:I-86:II)	1.06* (3.53) (68:I-71:III)	2.14* (6.44) (73:I-86:II)

- The assumption of lag structure on the real income variable, GDP, did not improve the present result.

Table 10. Real Income Elasticities of Demand for Exports

$$LnX^d_t = \beta_0 + \beta_1 \, Ln\, W_t + \sum_{i=0}^{n1} \gamma_{2i} \, Ln\, PX_{t-i} + \sum_{i=0}^{n2} \gamma_{3i} \, Ln\, PFM_{t-i} + \epsilon_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	1.95* (2.84) (62:I-83:IV)	2.22* (2.38) (62:I-71:III)	2.41* (2.46) (73:I-83:IV)
Venezuela	0.25* (2.10) (62:I-83:IV)	0.158 (0.611) (62:I-71:III)	0.40* (1.55) (73:III-83:IV)
Saudi Arabia	2.60* (11.94) (62:I-83:IV)	1.31* (9.28) (62:I-71:III)	1.46* (3.14) (71:IV-83:IV)

- The assumption of lag structure on the real income variable, GDP, did not improve the present result.

Table 11. The Long-run Import Price Elasticity of Industrial Countries' Wholesale Prices

$$\text{Ln } PM_t = \text{"}_0 + \sum_{i=0}^{m1} a_{1i} \text{ Ln } PFM_{t-i} + \sum_{i=o}^{n1} a_{2i} \text{ Ln } E_{t-i} + \mu_t$$

	Entire Period	B-W Period	Post B-W Period
Iran	0.99* (107.76) (60:I-86:III)	1.013* (35.19) (60:I-71:III)	0.942* (45.29) (71:IV-86:III)
Venezuela	0.987* (101.75) (60:I-86:III)	0.914* (33.57) (60:I-71:III)	0.938* (44.19) (71:IV-86:III)
Saudi Arabia	0.98* (66.39) (60:I-86:III)	0.724* (16.22) (60:I-71:III)	0.967* (33.31) (71:IV-86:III)

Table 12. The Long-run Export-Price Elasticity of Domestic Wholesale Price[1]

$$\text{Ln } PX_t = *_0 + \sum_{i=0}^{m2} d_{1i} \text{ Ln } PDM_{t-i} + \sum_{i=0}^{n2} d_{2i} \text{ Ln } E_{t-i} + <_t$$

	Entire Period	Post B-W Period
Iran	1.76* (17.39) (60:I-85:IV)	1.54* (10.17) (71:IV-85:IV)
Venezuela	1.49* (16.23) (60:I-86:III)	1.16* (10.15) (71:IV-86:III)
Saudi Arabia	2.15* (16.15) (63:I-85:IV)	1.95* (7.63) (71:IV-85:IV)

1 - For Saudi Arabia, instead of wholesale prices, the consumer price index has been utilized.