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DISSERTATION

THE IMPACT OF EXCHANGE RATE FLUCTUATIONS ON INTERNATIONAL TRADE: A CASE STUDY OF SAUDI ARABIA

Submitted by

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Department of Economics

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY ABID ABDALLAH AL-MASHAIKHI ENTITLED "THE IMPACT OF EXCHANGE RATE FLUCTUATIONS ON INTERNATIONAL TRADE: A CASE STUDY OF SAUDI ARABIA" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate Work

Co-Advisor

Advisor

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ABSTRACT OF DISSERTATION

THE IMPACT OF EXCHANGE RATE FLUCTUATIONS ON INTERNATIONAL TRADE: A CASE STUDY OF SAUDI ARABIA

This study investigates the impact of exchange rate fluctuations of the Saudi riyal vis-à-vis other currencies on the international trade flows of Saudi Arabia. It is argued that a country with a pegged exchange rate is affected by the exchange rate movements of major currencies as long as these currencies fluctuate against one another. Such movements can cause changes in a country's bilateral as well as its effective exchange rates, which in turn affect its trade flows from trading partners.

Since the advent of the floating exchange rates in the early 1970s, Saudi Arabia chose to peg its currency to the U.S. dollar, then to the SDR, and later switched back to the dollar-peg. Consequently, Saudi Arabia could not avoid fluctuations in its exchange rate against the currencies of its major trading partners.

This study empirically investigated the impact of exchange rate fluctuations on Saudi Arabia's trade flows. Both aggregate as well as disaggregate trade flows (i.e., both exports and import demand functions) were examined using annual time series data for the period 1973 through 1995. In assessing the impact of exchange rate variability on the trade flows of Saudi Arabia, a variety of exchange rate measures were used along with the other commonly used variables

The study found that cross-exchange rate fluctuations had an adverse effect on Saudi Arabia's trade flows. Both aggregate as well as bilateral trade flows were negatively affected by the exchange rate variability. At the aggregate level, both aggregate exports and imports are shown to have been adversely affected by this variability. The results of our estimates of the disaggregate exports and imports also confirm our hypothesis that cross-exchange rate variability has adversely affected Saudi bilateral exports as well as imports.

Other variables such as world income, relative prices, and domestic income were also found to have an effect on the Saudi trade flows, however, the effect is not uniform. The "oil gap" and other political factors have also played a significant impact on Saudi aggregate exports.

The impact of the exchange rate policy switch to the dollar-peg is shown to be negative on both exports and imports, however the magnitude of the effect is greater in the case of aggregate exports than imports. The implication of these findings is that pegging the riyal to the US dollar may not be the optimal policy of promoting Saudi exports. A better choice of exchange rate regime would be a switch to a trade-weighted currency basket. This basket should truly reflect the trade patterns of Saudi foreign trade.

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INTRODUCTION

Introduction

After the Bretton Woods agreement collapsed in March 1973, the industrialized countries floated their currencies while most developing countries chose to peg their currencies to the currency of their major trading partner(s), to a currency basket, or to the International Monetary Fund's Special Drawing Rights (SDR). The adoption of the floating system by the industrialized countries, however, imposed a considerable increase in exchange rate fluctuations for the less developed countries (LDCs).

Saudi Arabia, like many other developing countries, was faced with the question of which exchange rate policy to adopt in order to achieve its economic and development objectives. Shortly after the establishment of the Saudi Arabian Monetary Agency (SAMA), the Saudi riyal was fixed to the US dollar. In 1975, due to the changing international monetary system during the first years of the 1970s and the wide fluctuations of the US dollar against other major currencies, the Saudi government decided to link its currency, the riyal, to the SDR. The riyal remained officially pegged to the SDR throughout the 1970s and early 1980s. In June 1986, the riyal was devalued and re-pegged to the US dollar. Consequently, Saudi Arabia cannot avoid fluctuations in its exchange rate against the currencies of the major industrial countries so long as the dollar continues to fluctuate.

The Statement of the Problem

It is argued that a country with a pegged exchange rate is affected by the exchange rate movements of major currencies as long as these currencies fluctuate against one another. Such movements can cause changes in a country's bilateral as well as its effective exchange rates, which in turn affect its trade flows from its trading partners.

In the case of Saudi Arabia, with the advent of floating exchange rates in the early 1970s, pegging the Saudi riyal to the US dollar meant floating against all other currencies not pegged to the dollar. Moreover, as long as the riyal remains pegged to the US dollar, changes in Saudi Arabia's nominal exchange rates vis-a-vis currencies other than the dollar will occur strictly in response to changes in the value of the US dollar. Furthermore, the dollar has exhibited greater instability relative to the currencies of the other major industrial countries, causing the Saudi riyal to fluctuate against these currencies as well.

Against this background this study proceeds to investigate the impact of the exchange rate fluctuations of the Saudi riyal vis-à-vis other currencies on Saudi international trade flows. This analysis will take into account the many distinctive features of the Saudi economy, such as its high degree of openness and its heavy dependence on both exports and imports. The country's most important export is crude oil, which is priced in US dollars. Thus the instability of the dollar will result in substantial revenue and foreign exchange losses. In addition, the instability of the dollar against other currencies means the price of oil for non-US markets will be directly influenced by fluctuations in the dollar exchange rates. Consequently, the home currency

prices of oil in these markets will vary directly with the exchange rate of the US dollar, resulting in an adverse effect on Saudi exports.

Because the riyal is pegged to the dollar, significant fluctuations of the US dollar vis-à-vis other currencies mean that the Saudi riyal fluctuates against these currencies as well. Given the fact that Saudi Arabia is almost totally dependent on imports, fluctuations in Saudi riyal exchange rates may be harmful to imports as they can weaken the riyal's purchasing power.

The Purpose of the Study

The purpose of this study can be stated as follows:

I. To review the major theoretical and empirical studies on the impact of exchange rate fluctuations on international trade flows of both developed as well as less developed countries.

II. To develop models by which to test for the effects of exchange rate fluctuations on Saudi Arabia's trade flows. Both aggregate and disaggregate trade flows will be examined.

III. To test the hypothesis that exchange rate fluctuations of the Saudi riyal have an adverse effect on both exports and imports at both levels, the aggregate and bilateral levels.

Data and Methodology of the Study

In addition to the national sources, the data needed for this study have been collected from different sources such as the IMF, the World Bank, and the UN publications

Time-series data were used to test the hypothesis that exchange rate fluctuations have an adverse effect on the trade flows of Saudi Arabia. In most international transactions, goods are delivered after a time lag and the contracts are denominated in terms of the major trading countries' currencies such as the U.S. dollar, the Japanese yen, the British Pound, or the Deutschemark. Because of this, unanticipated variations in cross-exchange rates would adversely affect the value of trade through their effects on profit.

The model is first estimated using the time series data of both aggregate exports and imports for the period 1973 to 1995. Next, disaggregate data were used to estimate both bilateral exports and imports of Saudi Arabia with its major trading partners. A variety of exchange rate measures were used along with the other common variables to test the hypothesis.

The Plan of the Study

This study is organized as follows:

Chapter One: This chapter includes an introduction to the subject, the purpose of the study and the methodology.

Chapter Two: This chapter surveys the literature on the impact of exchange rate variability on international trade flows. It presents the major models for investigating the effect of exchange rate volatility on trade flows along with their specifications and findings. Studies relating exchange rate variability to trade flows range from the most aggregate level, in which exchange rate variability was thought to affect the growth of total world trade adversely, to less aggregate models where the focus was on bilateral trade flows. This chapter also reviews time-series as well as cross-sectional studies on the

subject. Additionally, studies concerned with developed as well as less-developed countries were presented in this review.

Chapter Three: Chapter three provides a brief background of the Saudi economy. It begins with the growth of the oil sector and shows how this sector dominates the economy of Saudi Arabia. Given the major contribution of the oil sector to total GDP, wildly fluctuating growth rates in this sector are reflected in the growth rates of the economy. Second, the chapter discusses the foreign trade sector of the economy. It focuses on the trade structure, the growth of exports as well as imports over time, the factors which affected this growth, and the geographical patterns of both exports and imports. Finally, this chapter discuses the Saudi exchange rate policy in more detail.

Chapter Four: This chapter introduces the models and their specifications used in this study along with their results. The empirical work was conducted by estimating both aggregate as well as disaggregate exports and import demand functions for Saudi Arabia's trade flows. The models were estimated , subject to data availability, for the period 1973 through 1995. In the process of the estimation, different measures of exchange rate were applied to assess the impact of exchange rate variability on the trade flows of Saudi Arabia.

Chapter Five: This final chapter summarizes the main findings and conclusions of the study. In addition, it provides some policy implications and recommendations.

Having briefly discussed the purpose and methodology of the study, let us now begin our examination of the literature regarding exchange rate variability and its impact on trade flows.

CHAPTER TWO

EXCHANGE RATE VARIABILITY AND INTERNATIONAL TRADE

A Review of the Literature

Introduction

Since the end of the Bretton Woods system, the impact of exchange rate variability on international trade has become an increasingly important issue. A principal concern is that exchange rate variability appears to increase the risk and uncertainty in international transactions and may therefore adversely affect trade and investment flows. This chapter reviews the major empirical studies of the effect of exchange rate variability on trade flows. The major models and their specifications are presented in detail. However, in the end, the available literature provides no definitive answer to the question of the impact of exchange rate variability on trade, as we will see.

Empirical work relating exchange rate variability to trade flows has taken place on several different levels. At the most aggregate level, attempts have been made to relate the growth of total world trade to the growth of world income, to determine whether this relationship changes in periods of exchange rate variability. However, due largely to the shortcomings of such an approach at this level, a number of studies have focused on the specification of models explaining changes in bilateral trade flows, including some measure of exchange rate uncertainty as one of the important determinants of bilateral

trade flows. Although some of these studies provide evidence supporting the view that exchange rate fluctuations tend to reduce international trade, the evidence is inconclusive, reflecting the disagreement among economists regarding the issues related to the empirical work in this area. First and foremost among these issues is the choice of a proxy for exchange rate variability. There are a large number of potential measures of variability, including the use of variance or standard deviation of the spot, forward, and effective exchange rates; variance of changes in the spot, forward, and effective exchange rates; the variability of the exchange rate around trends, and changes in trends in the exchange rate. None of these measures has been shown to consistently yield the expected result and thereby become the accepted measure. The choice between bilateral and effective or trade-weighted exchange rates, and between nominal and real exchange rates is another area of disagreement. Finally, the choice of time frame, lag structure and countries in the sample has been shown to also significantly change the results.

What follows is a review of the major empirical works exploring the effect of exchange rate variability on international trade since the end of the Bretton Woods system. These works, along with their major findings, are presented in chronological order and discussed in detail.

Hooper and Kohlhagen (1978)

An early and widely cited study of exchange rate variability in the Post-Bretton Woods period is that of Hooper and Kohlhagen (1978). They tested for the effects of

exchange rate uncertainty in sixteen cases involving U.S. and German multilateral and bilateral trade flows during the 1965-1975 period. Their model, unlike previous theoretical models which focused exclusively on either the export supply or the import demand side of the market, includes both sides of the market for traded goods. This approach enabled them to analyze the impact of exchange rate volatility on price as well as on volume, while allowing for differences in risk bearing between importers and exporters.

The model, in its linear form, is specified as follows:

$$P^* = c_0 + c_1\, UC^* + c_2\, UC + c_3\, PD + c_4\, Y + c_5\, CU + c_6\, EH^* + c_7\, EH + c_8\, ERU^* + c_9\, ERU \quad (1)$$

$$q^* = d_0 + d_1\, UC^* + d_2\, UC + d_3\, PD + d_4\, Y + d_5\, CU + d_6\, EH^* + d_7\, EH + d_8\, ERU^* + d_9\, ERU \quad (2)$$

where c_1, c_3, c_4, c_8, d_3, d_4, and d_6 are expected to be positive, c_0 and d_0 are expected to be either positive or negative and all other coefficients are expected to be negative. The variables are defined as follows:

P* = Price of exports (imports) in the exporting country's currency.

q* = Export quantify.

UC* = Unit costs of production in the exporting country.

UC = Unit costs of production in the importing country.

PD = Domestic Price level in the importing country.

Y = Income (nominal GNP) in the importing country.

CU = Capacity utilization in the importing country.

EH* = Exporter's expected cost of foreign exchange.

EH = Importer's expected cost of foreign exchange.

ERU* = Exchange risk for the exporters. This variable enters export supply equation as the average absolute difference within the quarter between the previous forward and the current spot rate.

ERU = Exchange risk for the importers. This variable enters import demand equation as the average absolute difference within the quarter between the previous forward and the current spot rate.

The linear reduced-form price and volume equations were estimated for each of sixteen cases involving German and U.S. trade with major industrial countries. The equations were estimated with a one-quarter lag on all of the explanatory variables. The exporting country's cost variable, UC*, and the importing country's income variable, Y, were found to be the dominant variables in both the price and volume equations. They were statistically significant (at a 95 percent confidence level) in about three-fourths of the cases. However, the authors could not conclude that the other cost and price variables of the importing country were relatively unimportant. This is due to the fact that these variables were correlated with the two dominant variables. The importers' weighted average exchange rate, EH, had coefficients with the expected sign in most cases and statistically significant in eleven out of thirty-two cases. Meanwhile, none of the coefficients on the exporters' exchange rate adjustment factor, EH*, were significant, and only about half had the expected sign.

Several alternative variables were tested as proxies for expectations of future foreign exchange risk. They included:

1) The volatility, as measured by the standard deviation over thirteen weekly observations within the quarter of the current spot exchange rate;
2) The volatility of the current forward exchange rate, and;
3) The average absolute difference between the previous forward and the current spot rate.

Of the three variables tested, the authors found that the third one was the best indicator of risk and yielded better overall equation fits than the standard deviation of either the current spot or the current forward rate.

In the price equations for U.S. exports and German exports and imports, the authors found that the risk variable had negative coefficients in nine out of eleven cases and was significantly negative at the 90 percent level in only six cases. This result, according to the authors, suggests that the impact of exchange risk was dominant on the importers side of the market, implying that increased exchange risk depressed import demand and caused the market price to fall. Whereas risk appeared to have a significant impact on the price of traded goods, the authors found no statistically significant impact on the volume of trade (at the 95 percent level) despite considerable experimentation with alternative functional forms of the model and alternative proxies for exchange risk. Only in the case of U.S. trade with the United Kingdom did the authors find a marginally significant negative impact on trade volume. The authors suggested that the absence of a significant impact on volume might be attributable to relatively inelastic export supply in

the short run. It may also reflect substantial hedging by importers and exporters. It should be noted however that the time period of the study (1965-1975) only covers three years of officially free floating exchange rates and this could have affected their results. In addition, the authors did not take into consideration the long-term effects of exchange rate uncertainty on international trade.

Cushman (1983)

To empirically analyze the effects of exchange risk on the volume and prices of trade, Cushman (1983) extended and modified the Hooper-Kohlhagen (1978) model in two ways. First, he extended the time period to 1977 to cover more years of the free floating exchange rate period. Second, he used a real as opposed to nominal exchange rate based measure of exchange risk. Cushman's (1983) econometric tests cover the same bilateral trade flows among the U.S. and five other industrial countries included in the Hooper-Kohlhagen study.

The model is specified as follows:

$$Q = a_0 + a_1 Y + a_2 CU + a_3 UC + a_4 UC^* + a_5 R + a_6 M + a_7 S + a_8 D$$

$$PX = b_0 + b_1 Y + b_2 CU + b_3 UC + b_4 UC^* + b_5 R + b_6 M + b_7 S$$

where

Q = Quantity of exports (imports).

Y = Income in the importing country.

CU = Capacity utilization in the importing country.

UC = Real unit costs in the importing country.

UC* = Real unit costs in the exporting country.

R = Real exchange rate.

M = A proxy variable for exchange rate variability. It is a four-quarter moving mean of the percentage change of the real exchange rate.

S = A proxy variable for exchange rate risk. It is a four-quarter moving standard deviation of M.

D = Dock strike dummy,

and a_1, a_5, a_8, b_1 and b_4 are expected to be positive, a_2, a_3, a_4, a_6, a_7, b_2 and b_7 to be indeterminate. The model above was estimated for the period 1965 through 1977 using quarterly data.

Cushman used the standard deviation of the percent changes of quarterly observations of real exchange rates over a one year period as the variability measure, and found it to be significant in six out of fourteen trade quantity cases. Cushman believed this result offered the best evidence for the negative effects of risk on trade volume. Regarding the real income variable, Y, Cushman's results were similar to those of Hooper and Kohlhagen, where income continued to clearly show the expected effect on trade. The real exchange rate, R, was also predominantly significant and had the expected signs.

The estimation results for M and S were fairly sensitive to the lags imposed on these variables. M had the expected negative sign (significant at the 5 percent level) in ten trade quantity cases and in eight trade price cases. Similarly, S, the risk measure, showed a significant negative quantity effect in six of the quantity cases. The signs and significance of M and S, as Cushman has acknowledged, are sensitive to specification of

the equations with respect to lags on M and S. According to Cushman, the fact that the negative effects of M and S occurred with lags supports the notion that exchange rate affects trade flows in the long-run to a greater extent than in the short run.

International Monetary Fund (1984)

A 1984 IMF study extensively reviewed the empirical works regarding the effect of exchange rate volatility on world trade, dealing largely with exchange rate variability among the major industrial countries. The reviewed works varied in their theoretical approaches. At the most aggregate level, studies focused on the relationship between the growth of total world trade and the growth of world income to see whether this relation changes in periods of exchange rate variability. At a less aggregate level, studies dealt with bilateral models, such as Cushman's (1983), which were based either on time-series analysis or as cross-section analysis. Finally, several survey studies were also discussed. Cushman's (1983) work was updated using data through 1981 but no significant change in the impact of exchange rate variability on trade was found. After extensively reviewing these studies, the IMF (1984) study concluded that

> the large majority of empirical studies on the impact of exchange rate variability on the volume of international trade are unable to establish a systematically significant link between measured exchange rate variability and the volume of international trade, whether on an aggregated or on a bilateral basis (IMF, 1984, p. 36).

To explain the failure to establish a statistically significant relationship between exchange rate variability and trade flows, the IMF study has suggested that it may be due to the use of inadequate measures of uncertainty; to the existence of other factors

overwhelming the impact of variability in the estimating equations; or to the presence of statistical problems that interfere with the effectiveness of statistical tests.

Akhtar and Hilton (1984)

Akhtar and Hilton (1984) estimated price and volume equations for aggregate exports and imports of manufactured goods for the United States and Germany using quarterly observations from 1974 through 1981.

> By explicitly taking into account the effects of domestic (foreign) income, relative prices, and exchange rate levels on import (export) volume, the impact of exchange rate variability on demand for traded goods can be isolated (Akhtar and Hilton, 1984, p. 14).

The authors also discussed the problem of defining exchange rate uncertainty and its relationship to observed variability of exchange rates and outlined the various direct and indirect ways through which uncertainty might affect the volume of trade. They argue that

> since there is no unique or precise way to measure exchange rate uncertainty, theoretical and empirical research on its effects has generally fallen back on some measure of exchange rate variability as a proxy for uncertainty (Akhtar and Hilton, 1984, p. 9).

For their empirical work, the authors rejected the use of real exchange rate variability in favor of the observed nominal exchange rate variability as the relevant proxy for exchange rate uncertainty. They concluded that exchange rate variability has a negative effect on the United States' and Germany's exports and imports. They offered the use of more recent data (covering the floating exchange rate period); their measure of average quarterly variability; and the explicit consideration of the impact of risk on volume

through prices as the reasons that their results differed from previous studies. Finally, the authors admitted that their results were sensitive to any substantial changes in the observation period. Since their conclusions were based on the floating rate experience of only two countries, Germany and the United States, they suggested that further empirical research on the experience of a broader group of countries would be necessary to reach more general conclusions regarding the significance of exchange rate uncertainty (Akhtar and Hilton, 1984, p. 16).

Gotur (1985)

Gotur (1985) extended the work of Akhtar and Hilton, which was limited to the United States and Germany, to include France, Japan and the United Kingdom. He then examined the robustness of their results with respect to changes in the choice of sample period, volatility measures and estimation techniques. The main conclusion of this analysis was that the Akhtar and Hilton methodology failed "to establish a systematically significant link between measured exchange variability and the volume of international trade." (Gotur, 1985, p. 476.)

In testing the robustness of Akhtar and Hilton's empirical results, Gotur (1985) found several shortcomings with their methodology. First, he argued, Akhtar and Hilton applied the Cochrane-Orcult (CO) correction for serial correlation to all least-squares equations as a routine procedure, without a preliminary check for the presence of serial correction in the ordinary lest- squares estimation. Second, their equations were estimated using

> a one-iteration CO procedure, which belongs to the class of 'two-stage' generalized least-squares correction procedures for serial correlation, rather than the more customary iterative CO procedure (Gotur, 985, pp. 485-486).

Third, by allowing for an eight-quarter lag structure for the exchange rate volatility variable and for the relative price variables, their analysis necessarily included observations from the period of fixed exchange rates. Fourth, their specification of the second-degree polynomial lag structure is questionable. Finally, their specifications of the effective exchange rates used to compute the volatility variables for each country were narrow.

Gotur duplicated the Akhtar and Hilton model with relatively minor changes to reflect his criticisms. The changes included the addition of France, Japan, and the United Kingdom to the United States and Germany as the countries studied. The sample period was changed from 1974-1981 to 1975-1983 to eliminate lagged data from the fixed exchange rate period. Lastly, a nominal volatility measure was obtained from the IMF and is considered to be broader and more representative.

Gotur obtains results for Germany and the United States, taking into consideration the above mentioned problems, that differ markedly from those of Akhtar and Hilton. He found that three of the four statistically significant results which Akhtar and Hilton made the basis for their conclusions are now either statistically insignificant or no longer have the "correct" sign. Moreover, the additional results obtained by the inclusion of France, Japan, and the United Kingdom failed to provide conclusive evidence that exchange rate volatility has had a statistically significant effect on trade flows.

Kenen and Rodrik (1986)

Kenen and Rodrik (1986) examined short-term volatility in the real effective exchange rate of eleven industrial countries and its impact on their manufactured imports. They employed three different measures of exchange rate volatility, and each measure had two versions, one using data for the 24-month period and the other using data for the 12-month period. Unlike previous studies, Kenen and Rodrik focused exclusively on a floating-rate period, 1975-1984, and estimated equations for global rather than bilateral trade flows using effective exchange rates rather than bilateral rates. Their analysis provided mixed results despite their efforts. Seven of the eleven volatility terms had the expected negative sign, but only four of these were statistically significant. However, the authors felt that their results support the hypothesis that short-term volatility of real exchange rate does have a depressing effect on the volume of international trade.

Bailey, Tavlas and Ulan (1986)

Bailey, Tavlas and Ulan (1986) examined the real exports of the big seven OECD countries from 1973 to 1984 using the absolute value of the quarter-to-quarter percentage change in the nominal effective exchange rate as the measure of exchange rate variability. Their results indicate that there was no adverse affect of exchange rate variability on the exports of any of the big seven countries over the period of flexible exchange rates. A unique feature of their model is that it includes a variable representing the real export earnings of oil-producing countries. The reason for including this variable was that it is a more important determinant of oil-exporter purchases from developed countries than their

GDP's, particularly after 1973. Since that time, both oil-producers' export earnings and their importance as export markets for industrial nations have increased greatly.

The regressions developed by Bailey, Tavlas and Ulan indicated that the major determinant of real exports for each of the big seven OECD countries was the real economic activity in the remainder of the OECD. Relative prices and oil revenues were also found to be significant. The equations did not indicate, however, that exchange rate variability exerted a negative and significant impact on the real exports of any of the big seven countries. The authors suggest that their results differ from other recent studies due to the choice of the time period or the explanatory variables they used.

Maskus (1986)

Maskus (1986) investigated the effects of real exchange rate variability on U.S. imports and exports during the floating exchange rate period of 1974-1984. The investigation focused on only four U.S. trading partners, namely Canada, Germany, Japan and the United Kingdom. Maskus's approach, however, has two distinguishing features. First, while he followed the theoretical model developed by Hooper and Kohlhagen, he examined the effects of exchange rate risk on the volumes of U.S. bilateral imports and exports in seven broadly-defined sectors for the 1974-84 period. Second, he developed a measure of risk that has a nominal exchange rate risk component and a price risk component. The gap between the current forward rate and the future spot rate is the measure of nominal exchange rate risk he employed. The price risk component of the real exchange rate risk is captured by using a model to predict inflation rates three months

into the future for both the U.S. and its four trading partners. The difference between predicted inflation rates and actual inflation rates were then used as a measure of unexpected price changes. Both price changes and the nominal exchange risk measures were combined to create a measure of real exchange rate risk. A sectoral analysis was provided because the author believed that exchange rate risk might affect industries differently, either because some industries are more exposed to risk than others or because industries may react differently to a given level of exchange risk. To isolate the impact of exchange rate risk on total and sectoral trade, Maskus estimated separate equations for total and sectoral U.S. exports and imports. Seven sectors (agriculture, crude materials, manufacturing goods classified chiefly by materials, chemicals, machinery, transport equipment, and miscellaneous manufacturing) were studied and a total of sixty-four equations were estimated. The results of the empirical work indicated that generally the exchange risk tended to reduce U.S. international trade during the 1974-84 period. Of the sixty-four equations, fifty-eight had a negative coefficient on the exchange rate risk variable, indicating a negative effect of risk on trade. Of the fifty-eight negative effects, twenty-six were statistically significant.

Thursby and Thursby (1987)

Thursby and Thursby (1987) looked at the bilateral trade flows of seventeen industrial countries for the period 1974 to 1982 and found strong support for the hypothesis that increased exchange rate variability affects bilateral trade flows. The measure of variability they used was the variance of the spot exchange rate around its

predicted trend. They estimated equations using both real and nominal measures of exchange rates. By including both measures, the authors were able to test statistically for whether the real exchange rate variability affects trade differently than the nominal exchange rate variability. However, the results for the sampled period were indistinguishable. The exchange rate term was negative and significant (at the 5% level) for eleven countries. Moreover, the exchange risk variable was negative and significant in ten cases. These results, according to the authors, provide strong support for the hypothesis that exchange risk affects the value of bilateral trade.

Cushman (1988)

Cushman (1988) tested for the real exchange rate risk effects on U.S. bilateral trade flows with six of its major trading partners from 1974 to 1983, using five different measures of real exchange rate variability, two of which had not been used before. Cushman used the same model developed in his 1983 study, but restricted the estimations to the floating rate period. Each bilateral equation was estimated using a different risk measure. Different lag structures were tried for both exchange rate and non-exchange rate variables and whatever yielded a better result was used for each variable. Significant negative effects were found in five of six U.S. import flows, and in two of six U.S. export flows, with one export flow showing a significant positive effect. Clearly, U.S. imports showed a more significant negative effect than exports and these results overall are consistent with several previously published results for aggregate trade flows.

Bahmani-Oskooee (1986)

Bahmani-Oskooee (1986) estimated aggregate import and export demand functions for a sample of seven developing countries (Brazil, Greece, India, Israel, Korea, South Africa and Thailand) using quarterly data on the relevant variables for the period 1973 to 1980. He was interested in whether changes in exchange rates and changes in relative prices affected trade flows differently. A simple form of aggregate import (export) demand functions relating the quantity of imports (exports) demanded by a country to the ratio of relative prices, domestic (foreign) income, and exchange rate was estimated. Since imports (exports) do not adjust instantaneously to their long-run equilibrium level following a change in any of their determinants, a distributed lag structure was imposed on both the relative prices and on the effective exchange rates. This lag structure was imposed in order to assess the relative speed with which trade flows respond to price and exchange rate changes. Assuming that trade flows adjust instantaneously to a change in any of their determinants (i.e., estimating the equations with no lags) the reported results for import functions showed that estimated price elasticities were generally low, indicating that relative prices do not have a significant effect on the imports of developing countries. Moreover, all estimated price elasticities were less than unity, confirming the view that developing countries have a price inelastic demand for imported goods. The estimated elasticities with respect to effective exchange rate were also very low (less than unity in all cases), indicating that the exchange rate does not have a significant effect on the imports of developing countries. The results for export functions showed similar patterns.

To assess the relative speed of adjustment of trade flows to a change in relative prices and to a change in effective exchange rates, Bahmani-Oskooee tried all possible lag combinations of those two variables with the maximum of eight lags on each variable. With few exceptions, the long-run coefficient estimates had the expected signs. For real income, the estimated coefficients were positive and statistically significant in most of the cases. The price lags were found to be longer than exchange rate lags in nine out of fourteen equations. In three import equations, price and exchange rate lags were approximately equal in length and in two cases exchange rate lags were longer than price lags. From these results, the author concluded that in the long-run, trade flows are more responsive to changes in the relative prices than to changes in the exchange rates.

Bahmani-Oskooee (1991)

In his 1991 study, Bahmani-Oskooee argued that, although some developing countries still fix their currencies to one major currency or to a basket of currencies, they cannot avoid fluctuations in their average exchange rate so long as major currencies float against one another. This fluctuation, in turn, could introduce uncertainty that may affect trade flows of developing countries. Using quarterly data from 1975 through 1985 to assess the impact of exchange rate uncertainty on trade flows, Bahmani-Oskooee estimated import and export demand equations for seven different developing countries than those he used in his 1986 study (Bahmani-Oskooee 1986). As a measure of exchange rate risk, he computes the exchange risk as the standard deviation of quarterly

percentage changes in the real effective exchange rate over the eight previous quarters. Import demand equations were estimated first including the price-term and exchange risk variables, and when the price term yielded either the wrong sign or was insignificant it was replaced with the real effective exchange rate variable. The same procedure was followed in estimating export functions. The estimated coefficient of the variability measure of the exchange rate in the import equation was found to be negative and significant in four of seven cases. The same variable carried a negative coefficient in five out of seven cases in the export demand function, but was significant in only three cases. The price ratio or the real effective exchange rate carried the expected negative signs in all import demand equations except two, and were all highly significant except in two cases. Similarly, they had the expected signs in all but two cases in the export functions, and were significant in four out of seven cases. Other variables were found to be of the correct signs and statistically significant in most of the cases. Bahmani-Oskooee found his results to be comparable to those of studies investigating industrial countries.

Bahmani-Oskooee and Ltaifa (1992)

Bahmani-Oskooee and Ltaifa's (1992) study is among the few studies that have explored the effect of exchange rate variability on developing countries. Unlike many previous studies, which used time-series data, this study utilizes cross-sectional data to assess the effects of exchange rate uncertainty on the aggregate export volumes of eighty-six countries. Of these, only nineteen were developed countries, the rest were developing countries. Thus, this study is distinguished from other studies by its use of cross-sectional

data rather than time-series, aggregate rather than bilateral export volumes, a more comprehensive measure of exchange risk based on the real effective exchange rate rather than a nominal effective rate or real bilateral exchange rate, and finally, its inclusion of a large number of both developed and developing countries. Moreover, two new variables were included in this model: the rate of devaluation of each country's exchange rate against the U.S. dollar, and a population variable. They also used the standard deviation of percentage changes in the real effective exchange rate as the exchange rate variability measure.

Bahmani-Oskooee and Ltaifa estimated the model for all countries combined as well as for DCs and LDCs separately. The results for all countries combined indicated that all estimated coefficients carried their expected signs and were all significant except the devaluation variable. Most importantly, it was found that the variability measure of the real effective exchange rate exerts a significantly negative effect on exports. The authors presented the results for each group separately, and reject the hypothesis that regression coefficients are the same for DCs and LDCs. Moreover, they found that the estimated elasticity of exchange rate variability is smaller for DCs than for LDCs, indicating that exporters in DCs may be subject to smaller risk than LDCs. The overall results, however, seem to provide strong evidence supporting the notion that exchange rate uncertainty has reduced the volume of aggregate exports for both developed and less-developed countries.

Bahmani-Oskooee and Payesteh (1993)

In his 1993 study, Bahmani-Oskooee continued to look at trade flows of LDCs, but this time he utilized the model developed by Kenen and Rodrik (1986). He investigated the response of the trade flows of six less developed countries to exchange rate volatility using quarterly data over the 1973 to 1990 period. Again, he used the variability measure of real effective exchange rate and the standard deviation of quarterly percentage changes in the real effective exchange rate. On the import side, Bahmani-Oskooee found that exchange rate volatility exerted significantly negative effects on the import volume of three out of six countries. Price term carried a significant negative coefficient in all but one case. Similar results were obtained for the export demand equations. The exchange rate variability measure was significantly negative in three of the six cases. Price term was also negative and significant, in all but one case. Comparing these results with his 1991 study, Bahmani-Oskooee found some results to be inconsistent for the same individual countries. He proposed that this may be due to the use of larger sample sizes, the use of the Almon Lag Procedure, or to the use of different models. However, he remains confident that the results of both studies demonstrate the adverse effect of exchange rate uncertainty on trade volume.

Chapter Summary

To summarize, then, this review has demonstrated the inconclusive nature of the existing empirical work on exchange rate variability. We have reviewed the major articles on the subject, illustrating the different approaches. The major examples of bilateral and

aggregate studies using real and/or nominal measures of variability have been discussed, as have time-series and cross-sectional studies. Additionally, studies concerned with developed as well as less-developed countries are represented in this review.

From this discussion and comparison, it becomes clear that the inclusion of additional data or variables, or slight changes in model specifications may significantly alter a study's results. Thus, we can conclude that more research is necessary to develop the most appropriate models for this type of research. The extreme variation in results based on how the models are formulated and variables defined would indicate that these measures must be further refined and standardized before any meaningful conclusions can be made.

CHAPTER THREE

THE ECONOMY OF SAUDI ARABIA

The Saudi economy is characterized by its high degree of dependence on oil. "Not only does oil provide the bulk of foreign exchange earnings, but also generates most budgetary revenues and through government expenditure, supports much of the economic activity in the domestic non-oil private sector" (Askari, 1990, p.19). Thus the Saudi economy can be divided into two major sectors, oil and non-oil.

THE OIL SECTOR

Oil was discovered in commercial quantities in 1938. However, it was not until the end of World War II that large-scale exploration and development of oil fields and facilities began at a faster rate. Table A3.1 (at the appendix) shows the total and average daily oil production as well as total revenues from oil in Saudi Arabia from 1960 to 1996. As can be seen from the table, Saudi oil output grew rapidly during the 1960s and 1970s. Production increased from about 481.3 million barrels (equivalent to 1.32 million per day (MBD)) in 1960 to 1,386.7 million barrels (3.80 MBD) in 1970 (EL-Mallakh 1982, p.55). While pre-1970 increases in the annual production of oil were approximately 5 percent, increased global demand and subsequent price increases stimulated production growth

levels to reach approximately 15 percent per annum since 1970 (ibid., p. 54). As the table indicates, Saudi oil output continued growing rabidly through the 1970s and early 1980s. It grew from an average of 4.77 MBD in 1971 to 9.90 MBD in 1980. However, the increase has not been steady (SAMA Annual Report, 1997, p. 279). Due to a depressed oil market in 1975, Saudi production of crude oil declined to 7.08 MBD, from 8.48 MBD in 1974. Then in 1977 it rose to a new peak of 9.20 MBD. Because of a plentiful oil supply in the world market, Saudi Arabia kept its production level below 8.5 MBD in 1978. In 1979, however, in the wake of the Iranian revolution and to compensate for the Iranian oil shortfall, Saudi Arabia increased its production to 9.53 MBD. Toward the end of 1980 the Saudi government raised its production once more, to over 10.3 MBD to compensate for output lost as a consequence of the Iran-Iraq war. This led to a record total production for the year at 3,623.8 million barrels (9.90 MBD). Total Saudi output for 1981 fell marginally to 9.81 MBD, but from early in 1982 onward a world glut of crude oil led to a decline in sales and production. As a result, all OPEC members reluctantly accepted quota ceilings to prevent a price war and a collapse in revenues. Total production for 1982 was 2,366.4 million barrels, an average of 6.48 MBD. In March 1983, OPEC agreed to reduce the official market price and to limit total OPEC output to 17 MBD. As a consequence, total Saudi output for 1983 was 1,656.8 million barrels, or an average of 4.5 MBD. In 1984, further constraints were placed on Saudi output by international market conditions, and average oil production was about 4.0 MBD.

It should be mentioned here, however, that in the 1980s Saudi Arabia acted as a "swing producer" within OPEC; adjusting its own production levels in order to keep overall production by OPEC member states within the organization's recommended limits to maintain higher oil prices. However, playing this role cost Saudi Arabia dearly. Its production level plummeted in 1985 to its lowest level since 1968 (see Table A3.1 and Figures 3.1 and 3.2), reaching 1,158.8 million barrels, or 3.17 MBD. Its share of production within OPEC decreased from 42.7 percent in 1981 to 20.9 percent in 1985 (Askari 1990, p. 42). The lack of agreement among OPEC members on pricing and production and the loss of revenues resulting from Saudi Arabia's much lower production levels led Saudi Arabia to change its oil policy and abandon its former role as a swing producer. It increased its output and sales by instituting a policy of pricing its oil on a "net-back" basis.

This shift in policy coupled with the decision of OPEC, at the end of 1985, to end its official quota policy and seek a greater share of the world market led to a surge in production that caused international oil prices to collapse in 1986, dropping below $10 a barrel in July. At this time, and with a new policy of discounting prices, Saudi Arabia succeeded in raising its production level above 5 MBD in the summer months (EIU, Country Profile 1980/90, p. 18). In June 1987 OPEC members agreed to increase their collective production by 800,000 barrels per day (b/d) to16.6 MBD. Under this revised arrangement, Saudi Arabia was allocated a quota of 4.343 MBD, with its actual average output in 1987 being close to the quota. During 1988 and 1989, due to a strong global demand for oil, OPEC was able to increase its quotas, with Saudi Arabia's individual

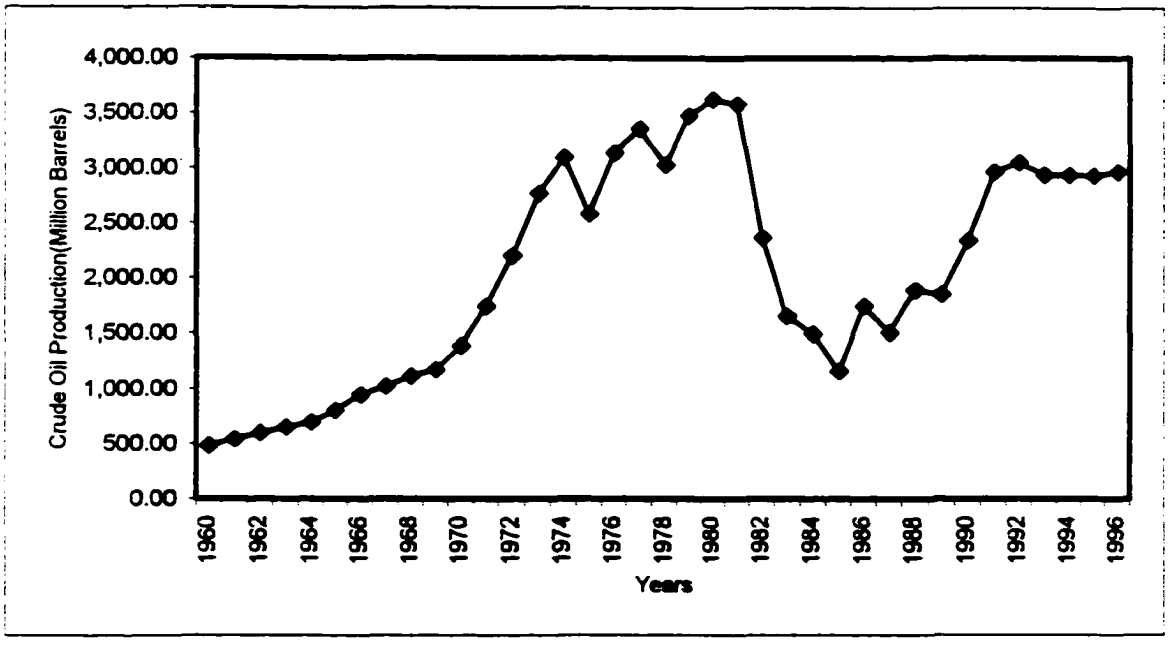

Figure 3.1: Saudi Annual Crude Oil Pdoduction.

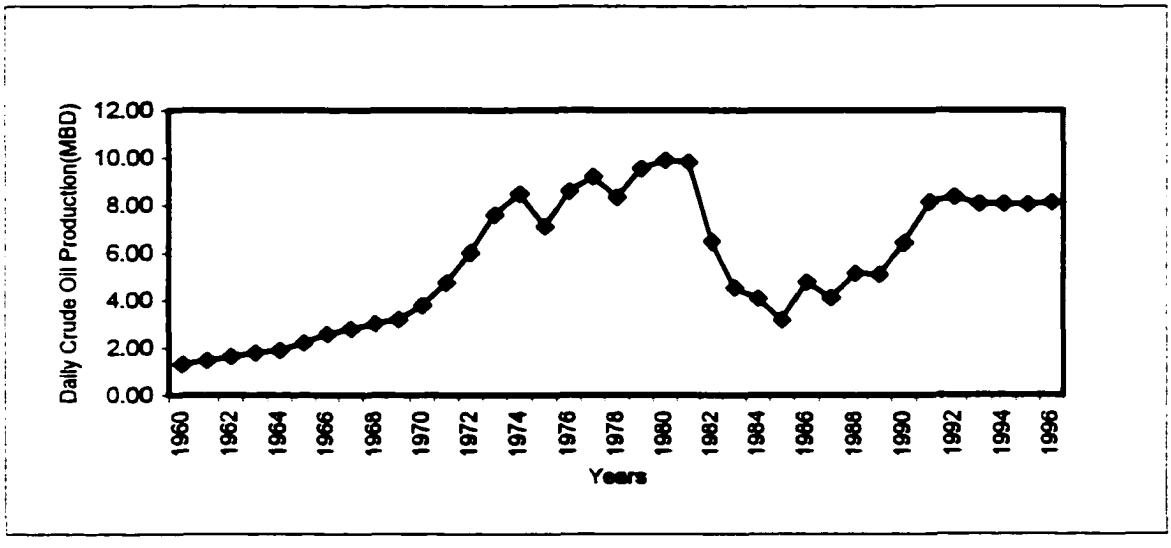

Figure 3.2: Saudi Daily Crude Oil Production.

quota rising back above 5 MBD (ibid., p.19). In 1989 the combination of growth in oil consumption and stagnation in non-OPEC oil production raised the demand for OPEC oil, however, this stability was quickly eroded during the first half of 1990 largely in response to the over-production of OPEC members during a period of unusually mild weather and weak oil demand which caused oil prices to drop once again to their 1988 levels (World Economic Survey 1991, p. 182). During the first three months of 1990, Saudi Arabia's estimated output was 5.52 MBD, with a quota of 5.38 MBD, while the second quarter output averaged at 5.34 MBD (EIU, Third Quarter 1990, p.14). However, by mid-August 1990, following Iraq's invasion of Kuwait on August 2nd, OPEC production was some 4 MBD below its ceiling because of UN sanctions that were imposed on Iraq and occupied Kuwait.

To compensate for the lost supplies from Iraq and occupied Kuwait, OPEC decided on August 29, 1990 to increase its output level as swiftly as possible. Therefore, the Saudi production level was boosted from around 5.5 MBD, just before the invasion, to 8.3 MBD by December 1990 -- an increase of 51 per cent. (World Economic Survey, 1991, p.195). For 1990 as a whole, Saudi production averaged 6.4 MBD. Throughout the Gulf Crisis Saudi Arabia maintained its high production level, reaching 8.54 MBD during the fourth quarter of 1991 and remaining significantly above 8 MBD throughout 1992. Saudi Arabia, however, accepted an OPEC quota of 8.39 MBD for the first quarter of 1993, to be decreased to 8 MBD thereafter. Output averaged 8.05 MBD in 1994 and 8.02 MBD in 1995. In 1996 Saudi output of crude oil averaged 8.10 MBD (SAMA, 1997, p. 279).

OIL REVENUES

The government is the sole owner of oil in Saudi Arabia. Thus, any increase either in production or in prices will result in higher government oil revenues. For Saudi Arabia, "the significance of oil revenue goes far beyond its being a source of finance. The contribution of oil-sector revenues both direct and indirect, is vital to the development program in general as well as to investment, balance of payments, foreign exchange earnings, currency and price stabilization and especially regional development and cooperation" (El-Mallakh, 1982, p. 60).

The fourth row of Table A3.1 shows the changes in oil revenues since the 1960s. The table demonstrates that oil revenues saw considerable growth during the 1960s, 1970s, and the early 1980s. The largest increase, however, came in 1974, when revenues rose more than 400 percent within a year, from about $4.3 billion to about $23 billion, reflecting a quadrupling of OPEC prices. By 1977, oil revenues had increased to more than 30 times their 1970 level, while output had only doubled in the same period. Oil revenues again increased during the 1979-81 period, largely due to the impact of the Iranian revolution and the Iran-Iraq war on the world oil market. Shortly after the Iranian revolution, Saudi Arabia boosted its output level to more than 10 million barrels per day (MBD). Total output in 1978 was 8.3 MBD, with government revenues reaching $32.2 billion.

By 1979, Saudi Arabia maintained an output level of around 9.5 MBD, an increase of 15 percent over previous years. A sharp increase in the price of oil in 1979 from $13.3 per barrel for Saudi light crude to $28 per barrel by May 1980, boosted

government oil revenues to a new high of $48.4 billion, an increase of about fifty percent over the previous year (see Table A3.1 and Figure 3.3). Prices continued to drift upwards with Saudi light crude reaching $32 per barrel by the end of 1980. Total government revenues for 1980 were $84.5 billion, an further increase of 74 percent over the 1979 figure. As the Saudi output level remained around 9.81 MBD, government revenue reached its highest level ever of about $102.1 billion in 1981 (SAMA, 1991, p. 250).

During 1982, world demand for oil began to fall, resulting in a 34 percent drop in Saudi output and a 31 percent drop in revenue. Both output and revenue continued their downward trend because of the weak demand for oil in the world market, increased competition from non-OPEC oil, and lack of discipline among OPEC members. As Figure 3.1 shows, Saudi output reached its lowest level of 3.17 MBD in 1985 with oil revenues at $18.3 billion, or about 18 percent of the 1981 level. In 1985, Due to a lack of agreement among OPEC members on pricing and production and the loss of revenues resulting from much lower production levels, Saudi Arabia decided to abandon its former role as a swing producer within OPEC, and increased its production level to 4.78 MBD in the last quarter of that year.

At the end of 1985, OPEC decided to end its official quota policy and seek a greater share of the world oil market in order to offset falling prices. This decision, coupled with the earlier change of policy by Saudi Arabia contributed to an abundance of oil in the world market, leading to a collapse of oil prices to below US $10 per barrel (Askari, 1990, p. 43). As prices collapsed, oil revenues in 1986 reached their lowest level, at $13.6 billion, since their peak in 1981. In late 1986, OPEC members agreed once again

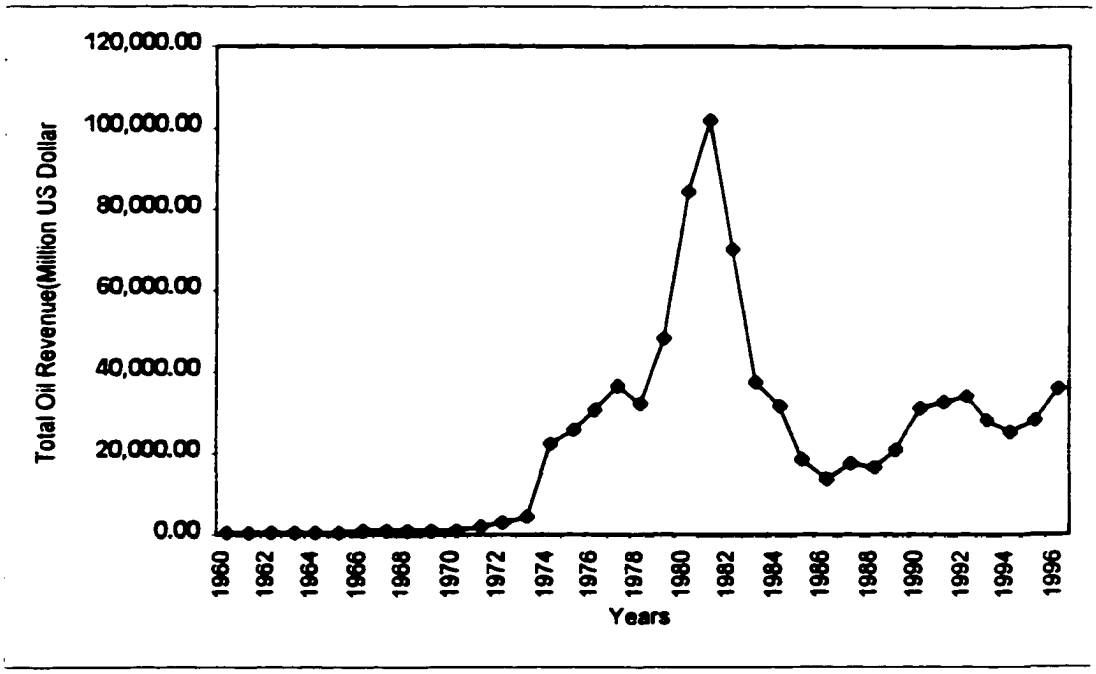

Figure 3.3: Total Oil Revenues

to limit their production levels and return to fixed oil pricing. As a result, the Saudi output decreased by about 14 percent during 1987 compared with the previous year, but oil revenues increased by about 29 percent. This increase in oil revenues was mainly due to improved oil prices as demand for OPEC oil rose in response to fears of possible interruptions of Gulf Oil supplies because of the ongoing Iran-Iraq war.

In 1988, Saudi Arabia once again refused to play the role of swing producer for OPEC and insisted on producing its full OPEC quota (EIU, Q2, 1986, p. 14). Although this new policy succeeded in keeping production levels at or even slightly above the quota, the total revenue from oil for 1988 was slightly lower than its 1987 level. World

oil prices strengthened in 1989, averaging $15 a barrel and giving rise to a total government oil revenue of about $24 billion (Aydlon, 1990, p. 297). During the first half of 1990, both Saudi oil production and prices dropped. The average spot price for Arabian light during the first six months of 1990 was $15.77 per barrel (EIU, Q3, 1990, pp. 12-14). By mid-August 1990, following the Iraqi invasion of Kuwait, spot market prices had risen sharply to about $28 per barrel and by September they had risen above $30 a barrel.

As mentioned before, Saudi Arabia responded to the crisis by boosting its production level from about 5.5 MBD in August 1990 to 7.65 MBD in September of the same year. For the whole of 1990, Saudi production averaged 6.41 MBD, producing a revenue of $31.1 billion (SAMA, 1991, p. 31). Oil revenues increased further in 1991 to about $32.9 billion. Oil prices, however, fluctuated during 1992, dropping to $15.54 a barrel for Dubai crude in the first quarter but improving again during the second quarter to $18.99 a barrel, the highest level since December 1990 (SAMA, 1991, p. 31). Prices weakened significantly during 1993 with Dubai crude averaging $14.93 a barrel, its lowest level since 1988 (SAMA, 1992, p. 24). Oil prices fluctuated further in 1994, improved in 1995 and recorded large increases in 1996, due largely to the economic growth in major industrial countries during 1996. The average price of Arabian light, for example, increased to $16.73 in 1995 and went up again to $19.91 per barrel in 1996. During the early months of 1997, however, oil prices recorded a declining trend due mainly to weather-related factors (SAMA, 1997, p. 21).

As oil prices have fluctuated during the 1990s, so have government revenues in Saudi Arabia. From $31.1 billion in 1990, oil revenues went up to around $34 billion in 1992 and down to about $28 and $26 billion in 1993 and 1994. The recovery in the world oil market during 1995 and 1996, however, helped to increase total government revenues substantially from SR 146.5 billion in 1995 to SR 179.1 billion in 1996, an increase of 22.3 percent (SAMA, 1997, p. 25).

Table 3.1 summarizes the growth rates of both crude oil production and revenues from 1960 to 1996. As can be seen from the table, both oil production and revenues registered an annual average growth rate of 10 percent and 13 percent respectively over the decade the 1960s. The decade of the 1970s witnessed the highest growth rates for both oil production and revenues, registering 12 percent and 70 percent respectively. Although the decade of the 1980s witnessed the peak of both oil production and revenues, during this period of time they also collapsed to their lowest levels. Both production and revenues declined by an average annual rate of 3 and 2 percent, respectively. From 1990 to 1996, both production and revenues grew at an average annual growth rate of 8 and 10 percent respectively.

OIL SECTOR AND GDP

The Saudi economy is dominated by the oil sector, which contributes the lion's share of the gross domestic product (GDP) and generally sets the pace of the overall level of economic and financial activity (Hitti, 1974, p. 273). Real GDP, measured in constant

Table 3.1: Average Annual Growth Rates of Crude Oil and Revenues(AAGR)
(Percentage)

	Period	AAGR (%)	Average	Minimum	Maximum	S.D.
Production	1960-1969	10	803.255	481.3	1173.89	247.7463
	1970-1979	12	2678.583	1386.67	3479.15	699.6461
	1980-1989	-3	2086.888	1158.8	3623.8	857.5231
	1990-1996	8	2874.599	2340.5	3049.4	239.0071
Revenues	1960-1969	13	648.39	333.7	949.1	235.8003
	1970-1979	70	20639.5	1214	48435.2	17017.01
	1980-1989	-2	41296.71	13554.8	102095.2	32324.65
	1990-1996	10	30901.13	25489.99	36315.09	3779.353

Notes: 1- AAGR = Average Annual Growth Rate
2- S.D. = Standard Deviations

Source: Calculated by the author from Table A3.1.

1970 prices, grew from $3.8 billions to nearly $16 billion in 1982, a fourfold increase over a 12-year period (Askari, 1990, p.2). Real oil GDP, for the same period, grew from $2.1 billion to $6.5 billion. The share of oil to total GDP, however, varies from year to year. It was close to 60 percent during the 1970s but declined to less than 30 percent in 1986, largely as a result of the decrease in Saudi oil production and oil prices. Table A3.2 shows the data for total GDP as well as oil and non-oil GDP.

As can be seen from this table and Figure 3.4, Total GDP was growing at a very fast rate in the early 1970s. In 1973 it more than doubled the previous year's level, with

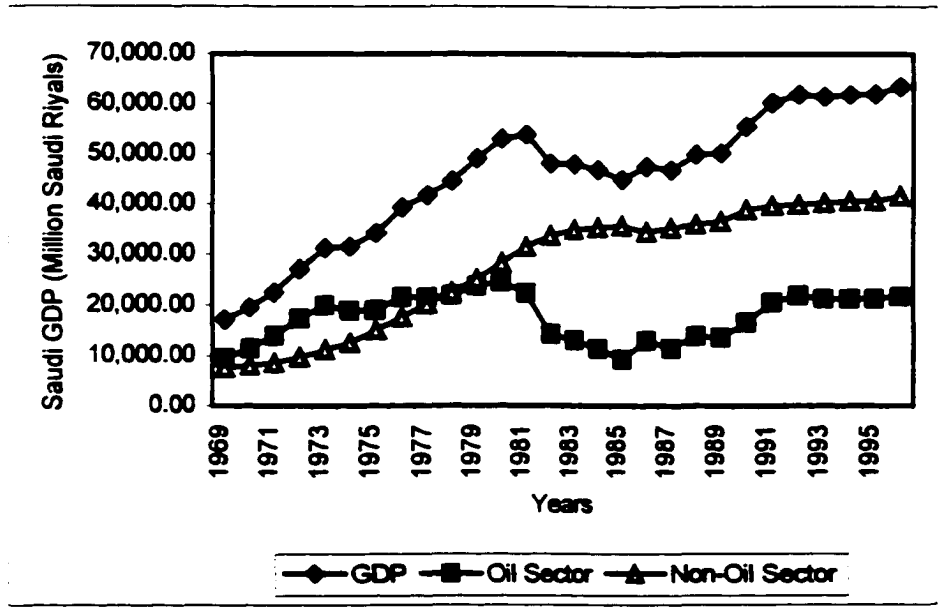

Figure 3.4: Saudi GDP by Sectors (at constant 1970 prices)

an increase of about 150 percent. Another jump took place in 1979 when, as a result of Saudi Arabia boosting its oil production level, total GDP increased by 55 percent and the oil sector's GDP jumped by about 80 percent. In both Table A3.2 and Figure 3.4, it can be seen that the GDP peaked in 1981 at about SR 522 billion. After this it began to decline, bottoming out in 1986. Oil GDP followed a similar pattern, peaking in 1980, and declining through 1986. After 1986, it began climbing once more, reaching SR 195.5 billions by 1996, a level that is still only about half of the 1980 peak.

This steep decline in both total GDP and oil GDP figures in the mid-1980s was a direct result of the fall in both Saudi oil production and world oil prices. The improvements in the world oil market during 1989, coupled with the Gulf Crisis precipitated by Iraq's invasion of Kuwait in 1990 gave rise to both oil and total GDP growth. The growth rates of nominal GDP, for example, was almost 10 percent during 1989, however, it jumped to almost 27 percent during 1990 and to 13 percent in 1991. The corresponding rates for the oil sector were 31 percent, 61 percent, and 14 percent for 1989, 1990 and 1991 respectively. The growth rates of total as well as oil sector GDP were much slower during the following years, however, 1995 to 1996 witnessed better performance in both total GDP and oil sector GDP. Table A3.3 presents the same information as in Table A3.2, however, at the constant prices of 1970.

The shares of oil and non-oil sectors of total GDP are presented in Table A3.4. As can be seen from the table, the oil-GDP ratio was at its highest level 1973 and continued to be high, ranging between 70 and 80 percent in 1980. Beginning in 1982, the share of the oil sector in total GDP began to decline, reaching its lowest level, 25 percent, in 1986 and 1988. Following 1988, the oil sector's share of GDP started to increase once again, and by 1996 it was almost 40 percent of the total GDP.

Table 3.2 details the average annual growth rates of GDP, oil sector and non-oil sector, both in nominal and real terms for 1970 to 1996. As the data shows, the Saudi economy registered impressive growth rates during the 1970s both in nominal and real terms. This is attributable mainly to the boom in the oil sector. Average annual real GDP growth rates were around 11 percent, while that of the oil sector was 10 percent, and the

Table 3.2: Average Annual Growth Rates of GDP, Oil and Non-Oil Sector

Year		Growth Rates are in Percentage		
		Total GDP	Oil Sector	Non-Oil Sector
1970-1979				
	Nominal	40.38	46.26	34.73
	Real	11.21	10.03	12.82
1980-1989				
	Nominal	-1.27	-6.55	5.29
	Real	0.37	-3.45	3.89
1990-1996				
	Nominal	7.76	13.51	5.35
	Real	3.49	7.42	1.9

Note: Real growth rates are calculated at 1970 constant prices

Source: Calculated by the author from Tables A3.2 and A3.3.

non-oil sector was at roughly 13 percent. Instead of exhibiting sustained GDP growth, GDP registered a negative average annual growth rate of about 1.3 percent during the 1980s. Oil GDP, for the same period, shrunk by an average rate of about 7 percent per year, largely because of the reduction in Saudi oil output levels and the sharp fall in oil prices in the second half of the 1980s. From 1990 to 1996, however, the Saudi economy witnessed improvement in its growth rates. Total GDP average annual growth rate, in

nominal terms, was about 8 percent, while the oil sector grew at an average rate of 14 percent. In real terms for the same period of time total GDP and oil sector growth was at an average annual rate of about 3.5 and 7.5 percent respectively.

In summary, overall economic performance in Saudi Arabia has been largely a reflection of the condition of the oil sector. Given the major contribution of oil to total GDP, wildly fluctuating growth rates in the oil sector, caused by instability in the world oil market, are reflected in the growth rates of the GDP.

THE NON-OIL SECTOR

The Saudi economy has a growing non-oil sector which includes agriculture, manufacturing, public utilities, construction and transportation and trade. The emergence of the modern non-oil sector, however, began in the 1970s and benefited greatly from the boom in the oil sector. Between 1970 and 1996, the contribution of the non-oil sector to total GDP fluctuated from as low as 16 percent in 1973 at current prices to 50 percent in 1982 and to over 75 percent in 1986, although this increase is somewhat overstated due to the drop in oil production (see Table A3.4). Table 3.2 also presents data regarding the average annual growth of this sector for the years 1970 to 1996. During the 1970s the non-oil sector registered a relatively high growth rate of about 35 percent per year. In real terms, however, the rate was about 13 percent for the same period of time. It is worth noting that while the oil sector recorded a negative real growth rate of 3.5 percent per year during the 1980s, the non-oil sector succeeded in sustaining an annual average real growth rate of about 4 percent for the same period. This, however, could be explained by

the fact that the Saudi Arabian government "maintained a high level of spending during the oil bust of the late 1980s, cutting back on some expenditures but drawing down reserves and running budget deficits to avoid having the full effects of the oil downturn reverberate through the economy" (Gause, 1994, p. 48). The contribution of the non-oil sector to total GDP continued to be above 60 percent throughout the 1990s (see Table A3.4) with an average annual growth rate of 7 and 2 percent per year, in nominal and real terms respectively, for the same period.

While the non-oil sector in Saudi Arabia includes agriculture, manufacturing, utilities, construction, and trade, this chapter will focus on the foreign trade sector, since the objective of this study is to investigate the impact of exchange rate fluctuations on this sector. This focus is appropriate considering that the objective of this study is to investigate the impact of exchange rate fluctuations on foreign trade.

THE FOREIGN TRADE SECTOR

The foreign trade sector plays a pronounced role in the Saudi economy. As a developing economy, Saudi Arabia depends heavily on both exports and imports, as demonstrated by Table A3.5, which shows the proportions of imports and exports as well as the total trade (X+M) to the total GDP from 1968 to 1996. During the 1970s, the ratio of total trade to GDP on average was 75 percent. However, this ratio reached 98 and 92 percent during 1974 and 1977 respectively. This picture changed dramatically during the latter half of the 1980s, however. In the early 1980s, total trade equaled almost 100 percent, but then decreased rapidly, reaching its lowest level at 54 percent in 1986. This

decline was due largely to the collapse of the oil market and the resulting reduction in oil production and exports (see Table A3.5). Throughout the first part of the 1990s, the share of total trade in GDP was above 60 percent, with the exception of 1994. It is interesting to note that both total trade and export shares of GDP exhibit almost identical patterns, reflecting the dominance of oil exports in the Saudi economy (see Figure 3.5). The export share of GDP, for example, jumped from 34 percent in 1973 to 91 percent in 1974 and stayed close to or above 60 percent for the rest of the decade. During the mid-1980s, due to worsening conditions in the world oil market, the export share of GDP declined, dropping as low as 28 percent in 1986. After 1986, with increases in production of oil and/or oil prices, the export share started to rise again, reaching 43 percent in 1990, after which it again began to decline, although slowly.

Obviously, the share of imports in the GDP is much smaller than that of exports. The import share of GDP ranges from as low as 7 percent in 1973 and 1974 to a high of 37 percent in 1983. Since then it has stayed below 30 percent.

From this discussion we can see the importance of foreign trade to the Saudi economy, measured by the share of total trade to Saudi GDP as well as the shares of exports and imports. With that in mind, let us move on to a detailed discussion of the structure and composition of trade in Saudi Arabia as well as the direction of that trade with the rest of the world. In the next section we will discuss Saudi exports, their composition and foreign destinations. This will be followed by a parallel discussion of Saudi imports.

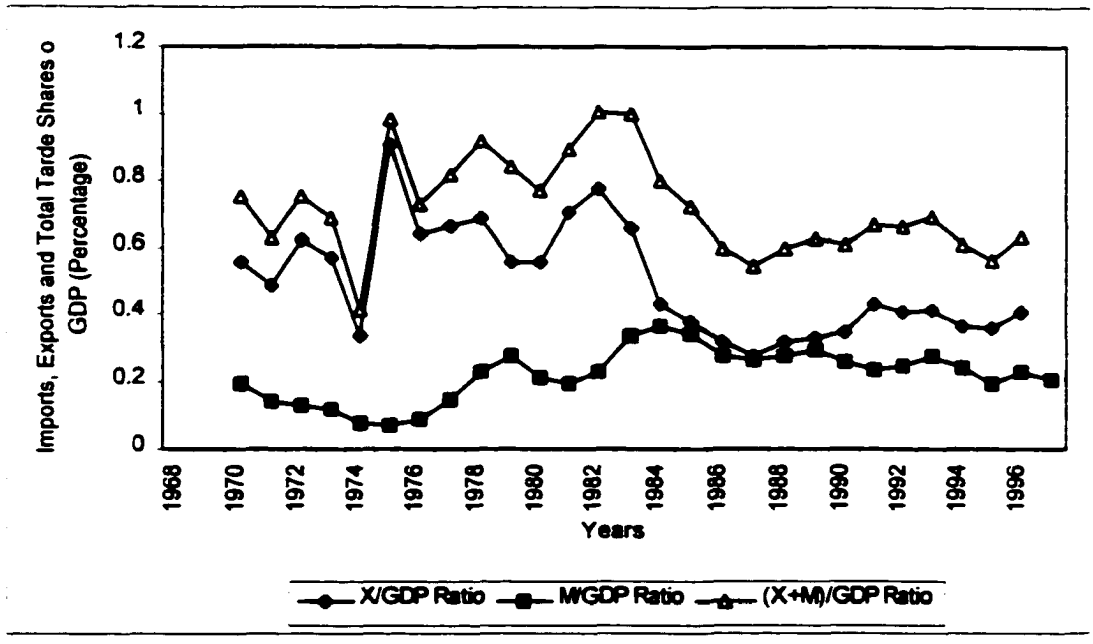

Figure 3.5: Imports, Exports, and Total Trade Shares of GDP

SAUDI EXPORTS: COMPOSITION

Saudi exports consist mainly of crude oil and oil-related products. Total crude exports increased from 501 million barrels (mbs) in 1962 to 1,020 mbs in 1969, with an average annual growth rate of about 11 percent for the period. During the same period, exports of refined oil increased from around 82 mbs to 158 mbs, with an average annual growth rate of 10 percent (see Table A3.6). During the 1970s, crude oil exports increased dramatically from 1.1 billion mbs in 1970 to 3.2 billion mbs in 1979, a nearly threefold

increase. Exports of refined products, on the other hand, fluctuated from as high as 213 mbs in 1973 to a low of 174 mbs in 1978.

The average annual growth rates for both crude and refined exports during this period were 13 and 2 percent respectively. The 1980s was an exceptional period in the history of Saudi oil exports. It witnessed both the highest and lowest levels ever of Saudi exports. Crude oil exports peaked in 1980 and 1981, then collapsed to their lowest level since the early 1960s (see Table A3.6 and Figure 3.6). Although growth rates of crude exports fluctuated from year to year during this decade, the overall average annual growth rate was a negative 6 percent per year throughout. It is interesting to note that although crude oil exports rose to their peak and then collapsed during the 1980s, the export of refined products grew in both absolute terms and as a percentage of crude exports and attained a growth rate of 11 percent throughout the decade.

Between 1990 and 1996, both crude exports and refined products grew at an average annual growth rate of 11 percent and 5 percent respectively. Crude exports in 1996 were about 2.2 billion mbs, still only 66 percent of the peak level of 1980. For the same year, 1996, the exports of refined products were 546 mbs, three times the 1980 level of 179 mbs. Although this increase in the exports of refined products may reflect the success of the government in boosting its exports of refined products and petrochemicals, the ratio of refined products to total crude oil exports has not yet exceeded 30 percent, except in 1988 and 1989. In fact, this ratio was very low, as low as 5 percent, during the 1970s and early 1980s. For most of the 1990s, however, the ratio has been above 20 percent (see Table A3.6: Sixth Column).

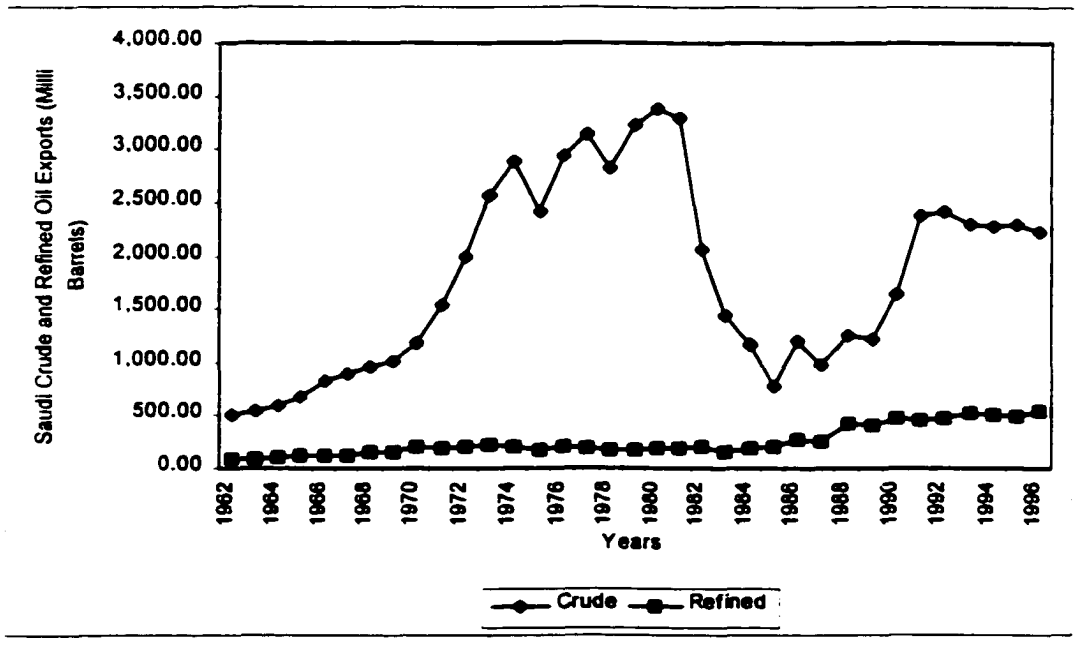

Figure 3.6: Saudi Crude and Refined Oil Exports

SAUDI EXPORTS: DIRECTION

Table A3.7 presents the pattern of Saudi exports to selected countries. This pattern has changed somewhat in the last three decades. Historically, Western Europe has been the primary recipient of Saudi exports, followed by the Asian countries. The Asian countries surpassed Western Europe as the leading importers of Saudi exports (mainly oil) for the first time in 1982, and they continue to hold that position throughout the 1980s and 1990s (see Table A3.8 and Figure 3.7a). Western Europe, received about one-half of the total Saudi exports during the 1970s, while Asia received, on average, 28 percent. The situation was reversed during the 1980s, and Asia imported about 40

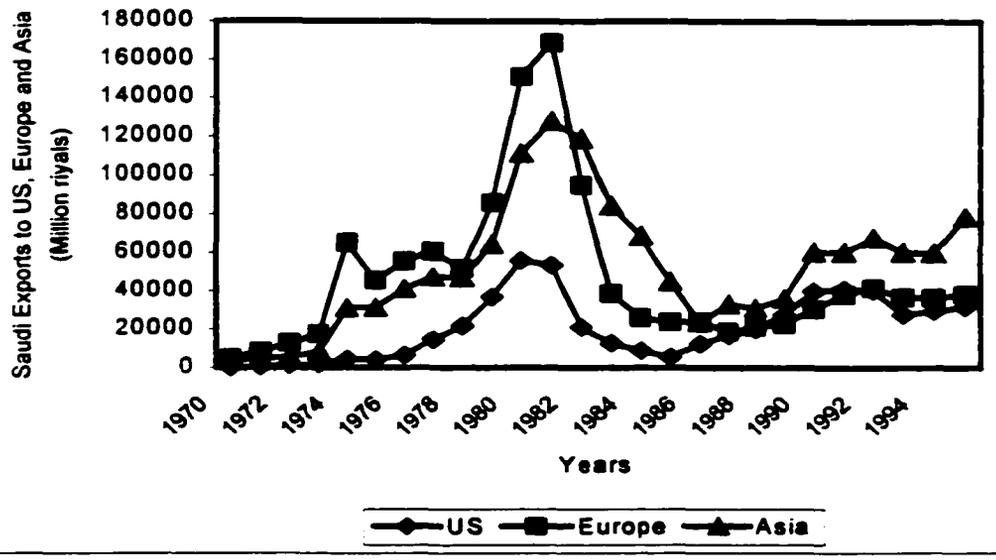

Figure 3.7a: Saudi Exports to US, Europe, and Asia

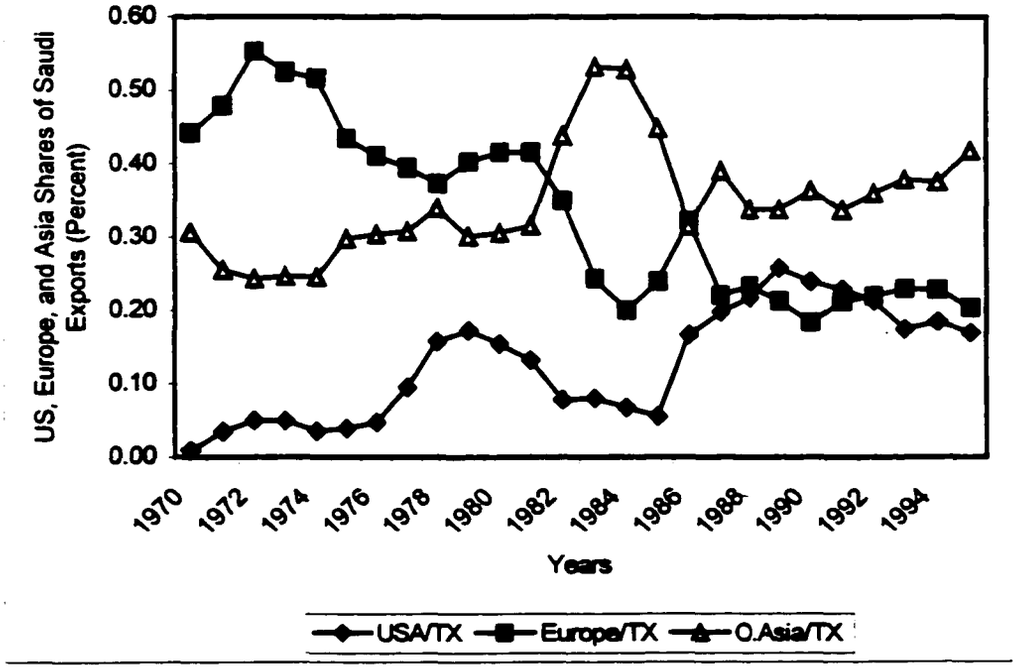

Figure 3.7b: US, Europe, And Asia Shares of Saudi Exports

percent, on average, of the Saudi exports, while Europe only averaged 30 percent. This trend continued from 1990 to 1995, with Asia, receiving roughly 37 percent, on average, of Saudi exports while Europe received 21 percent (see Figure 3.7b). It can also be seen clearly from Figure 3.7b that both Europe and Asia's shares of Saudi exports have almost always been greater than that of the U.S.

Japan has been and remains the largest single importer of Saudi crude oil, receiving 21 percent of the total export value in 1970 and 25 percent in 1975. Its share of Saudi exports peaked in 1984 at 32 percent and then declined to an average of 17 percent during the 1990s. The second biggest importer of Saudi oil is the U.S. While its share of Saudi exports was less than 5 percent prior to 1976, this share jumped to 10 percent in 1977 and to 17 percent in 1979. After 1979, the U.S. share began to decline, reaching its lowest level of 5 percent in 1985. After this it jumped again to 17 percent in 1986 and reached its highest level ever of 26 percent in 1989. During the early 1990s, up until 1995, the U.S. maintained a share, on average, of 20 percent of total Saudi exports. A comparison of Japan's share of Saudi exports with that of the USA shows that Japan maintained a much bigger share than the USA throughout the 1970s and a good part of 1980s. By 1988, the share of the USA had exceeded that of Japan and has remained so throughout the early 1990s.

Among the European countries, France, Italy, UK and Spain maintained, on average, shares of 10, 9, 6, and 5 percent respectively during the 1970s. During the 1980s, their relative shares were as follows: France 6 percent, Italy 5 percent, UK 2 percent, and Spain 2 percent. This declining trend has continued during the 1990s.

Germany received around 3 percent of Saudi exports during the 1970s and 1980s, however, its share dropped to only 1 percent during the 1990s.

Significant increases in market shares have occurred in Asian countries such as South Korea, Taiwan, Singapore, and India. Saudi exports to South Korea and Taiwan amounted to 399 and 280 million Saudi riyals (SR), respectively, in 1972. By 1981, the value of oil sold to South Korea had grown to SR 12 billion, nearly 30 times its 1972 level. Saudi exports to South Korea reached their lowest level of SR 1.5 billion in 1986, but began to grow during the following years, reaching a new record of almost SR 19 billion in 1995. By the same token, Taiwan's imports of Saudi oil have increased by about 24 times since the 1972 level, reaching SR 6.8 billion in 1982. In 1995, Taiwan's (China) imports of Saudi oil reached SR 5.5 billion (see Table A3.7). In terms of the shares, South Korea increased its share of Saudi exports from an average of 2 percent during the 1970s to 3 percent during the 1980s. During the early 1990s, its share, however, climbed to 10 percent in 1995, with an average of 7 percent for 1990s. Taiwan's share was between 2 percent and 4 percent during the 1970s and 1980s respectively. Its share dropped to 3 percent during the 1990s.

Other important importers of Saudi oil are Singapore and India. During the late 1970s, Singapore's share of Saudi exports was 4 percent. This had gone up to 7 percent by 1983. Throughout the 1980s and 1990s, Singapore has maintained its share of, on average, around 5 percent. India, on the other hand, has a growing share of Saudi exports. Its share rose from 1 percent during the 1970s to 3 percent during the 1990s.

SAUDI IMPORTS

Saudi Arabia's imports have grown significantly in recent years, reflecting the dynamic process of development of the Saudi economy. Total imports have grown from about SR 3.2 billion in 1970 to SR 14.8 billion in 1975, almost a fivefold gain, and imports continue to rise. From 1975 to 1982, imports increased by more than nine times and reached a peak of SR 139 billion in 1982, with an annual average growth rate of 41 percent per year over the period of 1975 to 1982 (see Table A3.9). "This sharp rise in the value of imports for these years may be attributed in part to inflationary price trends, especially during the 1970s. However, a large portion of the increase in the total value of Saudi imports must be attributed to the satisfaction of development requirements for the development plans and an increase in the marginal propensity to import in the private sector" (El-Mallakh, 1980, p. 348).

Following this period of rapid growth, the value of imports declined by more than 50 percent in the subsequent four years, ending in 1986. The value of total imports in 1986 was SR 70.8 billion, as compared with SR 139 billion in 1982. This sharp decline in imports was largely a result of the substantial reduction in domestic consumption associated with a drop in government spending. This drop was largely precipitated by the sharp drop in oil revenues and the related stagnation in private sector economic activity during this period. Imports rose again in 1987 and 1988, however, the biggest rise came between 1990 and 1992. This time imports surged in response to the upturn in domestic economic activity and the additional government expenditure associated with the Gulf War. Total imports reached another peak in 1992, when the total value of imports was SR

124.6 billion, about 90 percent of its 1982 level. During 1993 and 1994, because of cutbacks in government expenditure and a slowing down of private-sector activity, import demand declined. Nevertheless, imports rebounded strongly in 1995 to SR 105.2 billion.

COMPOSITION OF IMPORTS

Table A3.10 reports the composition of imports for Saudi Arabia. A major change in the composition of imports is the declining relative importance of food stuffs and the increasing importance of investment goods. "Before the massive move towards industrialization that followed the equally massive income increases of the 1970s, the most important imports were mass-consumption products: food items, cigarettes, medicines, automobiles, and textiles" (Johany, 1986, p.72). Food items, the sum of the first four items in Table A3.10, increased from about one billion riyals in 1970 to a peak of SR 18.2 billion in 1982.

Despite this huge increase in the absolute value of food items, its relative share of total imports declined from about 32 percent in 1970 to 13 percent in 1982. The leading import market has been in machinery, mechanical appliances, and electrical equipment. The totals in this category increased from SR 590 million in 1970 to SR 35,536 million in 1982, with its share of total imports increasing from about 18 percent in 1970 to 26 percent in 1982. The second-largest import category is transport equipment, which has risen from SR 428 million in 1970 to SR 24,034 million in 1982, a share of 13 percent of total imports rising to 17 percent over the same period. Imports of base metal and articles of base metals have been the third largest. They have risen from SR 300 million in 1970

to SR 20,716 million in 1982. The relative share of total imports for this category was between 9 percent and 15 percent for the years 1970-1982.

Another important import category is textiles. It grew from SR 142 million in 1970 to SR 9,056 million in 1983, with a relative share ranging between 4.4 percent and 7 percent for the same period. For most categories of imports, 1982 was the peak year after which imports began to decline due to the general downturn of the Saudi economy following the collapse of the oil market and the subsequent reduction in oil revenues and government expenditures. This downward trend continued, for most categories, until 1986. At this point, a general recovery of the Saudi economy began, though slow, and many import items began an upward trend once more. A big boost in imports came in 1990 and 1991 as a result of the upturn in domestic economic activity and additional government expenditures associated with the Gulf War.

THE ORIGINS OF IMPORTS

Saudi Arabia gets a substantial portion of its imports from the industrial countries, particularly Western Europe, the USA and Japan. Table A3.11 presents the Saudi Arabian imports from selected major industrial countries for the period 1970 to 1996. As can be seen from the table, the top five exporters to Saudi Arabia in 1970, in order, were the U.S., Japan, West Germany, the UK and Italy. These five countries accounted for almost 50 percent of total Saudi imports in that year. In 1975, the same ranking prevailed except that the UK has exceeded West Germany. Those five countries still accounted for about 51 percent of total imports. In 1980, the corresponding ranking was the U.S., Japan, West

Germany, Italy and the UK. In 1984, however, Japan for the first time came in ahead of the U.S. as the largest exporter to Saudi Arabia.

Japan maintained its position as the major exporter to Saudi Arabia for the years 1985 and 1987, after which it fell back once more to the second position, behind the U.S. In 1990, Japan remained second, however, in 1996 it fell back to fourth, preceded by the U.S., the UK, and Germany. It is interesting to note that, more or less, these five countries accounted for between 61 percent and 52 percent of the total Saudi imports between 1980 and 1995.

Western Europe, when taken as a whole, has the largest share of Saudi imports. It has dramatically increased its share of the total from 36 percent in 1970 to 45 percent in 1978. Throughout the 1980s and 1990s its share was around 41 percent. Among the European countries, West Germany, the UK, Italy, France and Switzerland are the most important suppliers to the Saudi market. West Germany and the UK compete for first and second place, followed by Italy and France. West Germany, was in first place for the entire period of 1976 to 1986, with its share ranging between 8 percent and 11 percent (see Table 3.3). The UK maintained its share on average of around 7 percent, but rose to above 10 percent during 1990s. The UK maintained its first position among the European countries for the entire period of 1987 to 1996.

As a single country, the USA is the most important trade partner to Saudi Arabia, supplying an average of about 19 percent of total Saudi imports for the decades of the 1970s and 1980s. Its share rose to about 21 percent during the 1990s. As already discussed, the second-largest single supplier was Japan. Its share expanded from 9

Table 3.3: Saudi Import Shares from Selected Countries
(percentage of total imports)

Year	US	Canada	Europe	France	German	Italy	UK	Japan	S. Korea	Switzerland	Taiwan	Spain	Asia
1970	18		36	3	10	4	7	10		1			19
1971	17	0	35	2	8	4	9	11		1			19
1972	19	0	31	2	6	4	7	14	0	1	1	0	22
1973	20		29	2	6	3	6	16	0	1	1	0	23
1974	17	0	27	2	6	3	5	16	0	1	1	0	23
1975	17	0	31	2	7	4	8	15	1	3	1	0	21
1976	19	0	35	3	8	5	6	12	1	4	1	0	18
1977	19	0	38	3	8	6	6	12	1	3	2	1	20
1978	21	0	45	4	11	7	7	15	2	3	2	1	25
1979	20	1	45	5	11	7	7	16	2	2	2	1	26
1980	20	0	43	5	9	7	6	18	2	2	2	2	29
1981	21	0	42	6	10	7	6	18	3	2	2	2	29
1982	21	1	42	5	11	6	7	19	3	2	2	1	29
1983	20	1	43	5	10	8	6	19	3	2	2	2	30
1984	17	1	41	8	8	7	6	20	3	2	3	2	30
1985	17	0	40	5	8	8	6	19	4	2	3	2	31
1986	17	1	40	6	8	7	7	16	4	2	4	2	29
1987	15	1	39	5	8	7	8	17	5	2	4	2	32
1988	16	1	38	5	7	6	7	16	5	2	3	1	31
1989	18	1	40	4	6	6	10	14	4	5	3	1	28
1990	17	1	43	4	7	5	11	15	3	7	2	1	27
1991	20	1	42	4	8	5	11	14	3	5	2	1	24
1992	23	1	41	5	7	5	11	14	3	5	2	1	24
1993	21	1	39	4	7	5	11	13	3	4	2	1	24
1994	21	2	39	4	8	5	8	12	3	4	2	2	22
1995	22	1	40	5	8	4	8	9	3	5	1	1	20

Source: SAMA Annual Reprot, various issues.

percent in 1970 to nearly 20 percent in 1984. During the 1990s, its share has averaged 12 percent of total Saudi imports.

Asian countries are another important supplier to the Saudi market. The share of imports from Asia was 22 percent, on average, in the 1970s. This increased to 30 percent in the 1980s and dropped to 23 percent in the 1990s. Among Asian countries, South Korea and Taiwan (China) have a growing market in Saudi Arabia. Total imports from South Korea have grown from SR 7.7 million in 1972 to a peak of SR 3,884 million in 1983. Similarly, Taiwan's share has grown from SR 62.6 million in 1972 to a peak of SR 3,245 million in 1983. The relative shares of these two countries in the Saudi market was 0.16 percent and 1.3 percent in 1972 for South Korea and Taiwan respectively. By 1987, however, their relative shares had risen to almost 5 percent and 4 percent respectively. During the 1990s, South Korea has maintained an average share close to 3 percent while that of Taiwan (China) remains at around 2 percent. Figure A3.1 shows Saudi imports from selected countries in terms of Saudi riyals (SR) while Figure A3.2 presents the relative shares of these countries in the total Saudi imports.

SAUDI EXCHANGE RATE POLICY

The official currency of Saudi Arabia is the Saudi riyal (SR). Following the monetary reform of 1959, the initial par value of the Saudi riyal was established in January 1960 at 0.197482 gram of fine gold per Saudi riyal. This par value of the riyal in terms of gold was equivalent to SR 4.50 = US$1 (= SDR 1). This new par value replaced the former official rate of SR 3.75 = US$1 as well as the free market rate for the dollar

(Hitti, 1974). The value of the Saudi riyal was kept stable vis-à-vis the dollar at the rate of 4.50 riyal per dollar until the dollar departed from gold in 1971 (Young, 1983).

Following the devaluation of the US dollar in 1971, the rate for the US dollar changed from SR 4.50 to SR 4.14475 in December 1971, representing an appreciation of 8.57 percent, while the riyal maintained its gold content of 0.1975 gram per riyal. In February 1973, the rate for the US dollar changed again to SR 3.73 per one US dollar, representing an appreciation of the riyal against the dollar of 11 percent. In August 1973, Saudi Arabia revalued the riyal against gold by 5 percent, with the new par value of 0.207510 gram of fine gold per Saudi riyal. The new value of Saudi riyal was equivalent to SR 4.28255 per one unit of the SDR. "The change represented an appreciation of the Saudi riyal by 5.1 percent in terms of SDR" (Hitti, 1976, p. 306).

SAUDI RIYAL PEGGED TO THE SDR

Following the final collapse of the Bretton Woods agreements in 1973 and the resulting increased instability of the dollar exchange rate against the major currencies, the Saudi government chose to peg its currency to the SDR on 15 March 1975. For transaction purposes, the Saudi riyal was linked to the US dollar "through the equivalent gold parities and determined third currency rates through the quotation of third currencies against the dollar. This arrangement, however caused the Saudi riyal to depreciate, along with the dollar, against several major currencies in 1974, including the currencies of major industrialized countries which supply the bulk of Saudi Arabia's imports" (Edo, 1975, p. 523).

In response to this situation, Saudi Arabia decided in early 1975 to link its currency to the SDR at the official parity of SR 4.28255 per SDR, rather than to the US dollar. "In order to isolate the riyal from daily fluctuations in the exchange rates, the government maintained a trading band of plus or minus 7.25 percent around party" (Abdeen, 1984, p. 44). This means that the riyal can fluctuate upward or downward against the SDR within a 14.5 percent margin. It also means that

> the Saudi authorities retained, therefore, the flexibility to control and direct the value of the Saudi riyal in a way that suits the financial priorities of the country. The Saudi Arabian Monetary Agency (SAMA) did from time to time change the exchange rate of the riyal against the dollar presumably to reflect movement of the riyal vis-à-vis the SDR" (Azzam, 1988, p. 160).

The government's objective of linking the riyal to the SDR was to isolate the riyal from the undesirable fluctuations of the riyal that were associated with the dollar peg, especially during the time of the changing international monetary system during the early 1970s and the resultant fluctuations of the US dollar against other major currencies.

BACK TO THE DOLLAR PEG

The Saudi riyal is officially linked to the value of the SDR. However, it has been effectively pegged to the US dollar since 1981.

> This change in policy was due to the substantive appreciation of the dollar vis-à-vis the other major currencies. Buy mid-1983, the Saudi riyal had deviated from its par value to the SDR by more than 7.25 percent. And, in the face of an appreciating dollar, the riyal was subjected to several devaluations, vis-à-vis the dollar" (Askari, 1990, p. 139).

For example, on April 6, 1982, the monetary authorities began a series of small devaluations of the riyal, adjusting its effective rate to SR 3.43 per US dollar from SR 3.42, and then to SR 3.44 on June 30th. (World Currency Yearbook, 1986-87)

> The riyal continued to weaken during the 1980s, declining gradually to SR 3.49 per US dollar by August 1982. With a system of mini devaluation in 1983, and in the face of declining oil revenues and a strong US dollar, the riyal tumbled to SR 3.52 per (dollar) at the close of the year, and to SR 3.70 per US dollar in February 1984, its lowest level in more than a decade" (ibid, p. 775).

The riyal also underwent three devaluations in 1985. It was devalued by 0.6 percent in February followed by 0.3 percent in March and 1.1 percent in June (ibid.). In June 1986 the riyal was devalued from SR 3.65 to SR 3.75 per US dollar, and has remained there ever since. (Euromoney, Guide to Currencies 1994).

Table A3.12 shows the monthly exchange rate of the Saudi riyal against the SDR for the period 1970-1997. As can be seen from the table and Figure 3.8, the Saudi riyal, after an initial depreciation against the SDR, appreciated by 5.5 percent, compared to the official rate, by the end of 1976. The appreciation is more pronounced, about 25 percent, when compared with the 1974 level. Between 1976 and 1979, the riyal began a depreciating trend and by 1979 it had depreciated by 1.4 percent, compared to the official rate (34 percent compared to the 1974 level). During the period from June 1981 to November 1985, the riyal exchange rate vs. the SDR was outside the 7.25 percent band, appreciating from SR 3.99 = SDR1 in 1981 to SR 3.68 in 1985, or 14 percent relative to the official parity of 4.28255 (see Figure 3.8). "This divergence became quite large as the dollar appreciated vis-à-vis other currencies during the period of 1981-1984" (Askari,

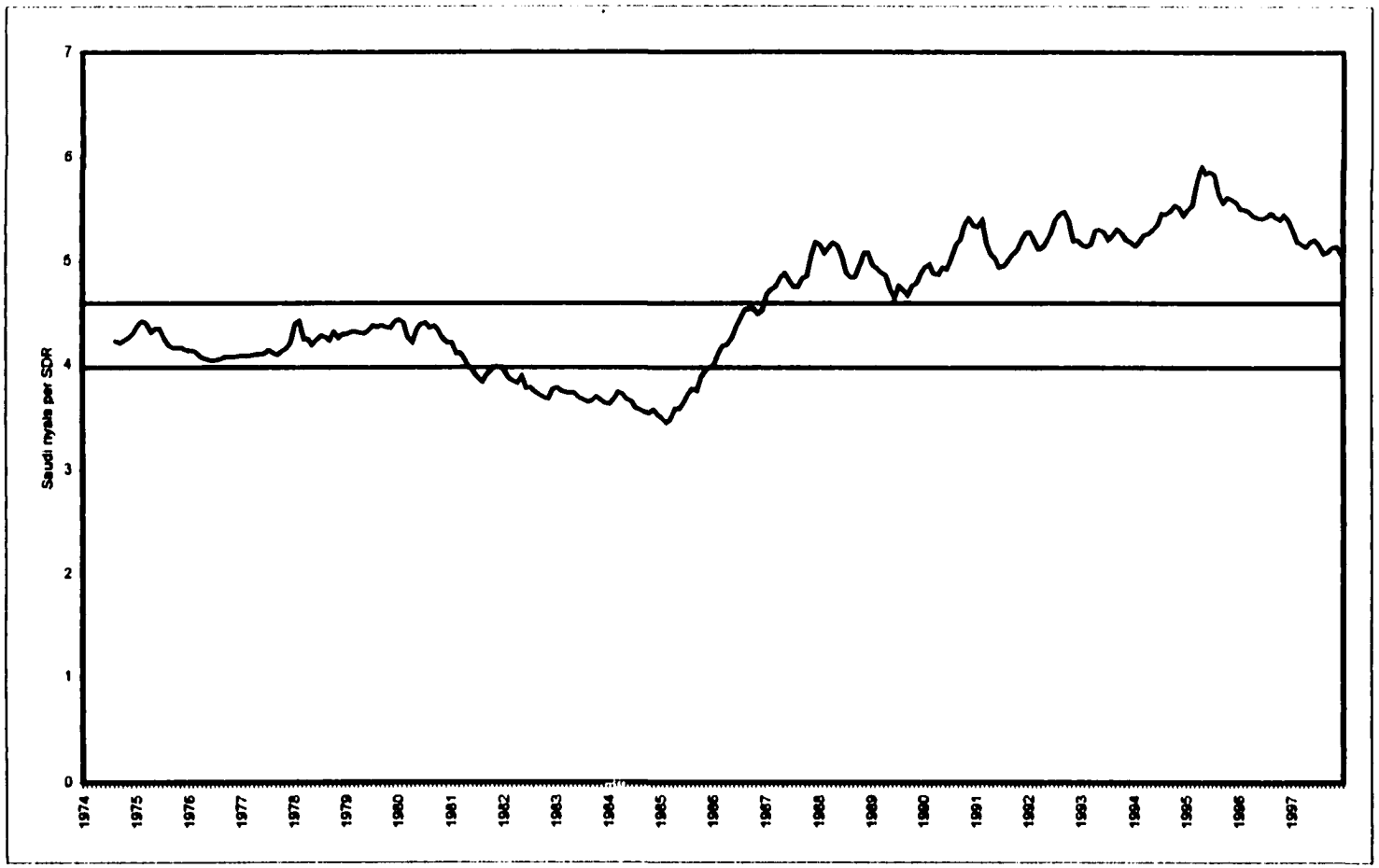

Figure 3.8: Saudi riyal per SDR.

1990, p. 139). The riyal reached its peak of SR 3.61 per SDR during 1984, after which it depreciated until it reached its lowest level of SR 5.683 per SDR in 1995, a 33 percent depreciation compared with the official rate.

Table A3.13 shows the annual exchange rates of the Saudi riyal against the US dollar as well as the SDR. As can be seen from the table as well as Figure 3.9, the riyal was fixed to the dollar from 1961 to 1970 at the value of SR 4.50 = US$1. The same rate prevailed against the SDR. After 1970, however, the riyal started appreciating against the US dollar and peaked in 1980 at SR 3.327 per US$1, an appreciation of more than 26 percent over the 1970 rate. After 1980, the riyal began its depreciating trend against the dollar and reached a value of 3.704 per dollar in 1986. In June 1986 the riyal was devalued from SR 3.704 to 3.745 per dollar and has remained fixed to the dollar since then. Overall, the riyal has depreciated by about 13 percent compared to its 1980 level.

Table A3.14 gives the exchange rates of the Saudi riyal against the major industrial currencies for the period 1973 to 1997. As can be seen from the table, and from the first panel of Figure 3.10, the Saudi riyal depreciated substantially by almost 48 percent against the DM up to 1979. Between 1979 and 1984, the riyal appreciated by about 42 percent against the DM. After 1984 the riyal depreciated again against the DM and reached its lowest level of the 1980s in 1987. From the peak of riyal in 1984 at SR 1.1356 per DM, it fell to SR 2.3680 per DM in 1987, a depreciation rate of more than 108 percent. From 1987 to 1997, the fluctuations in the riyal exchange rates against the DM were more pronounced than during the 1970s and early 1980s. By 1995, the riyal had

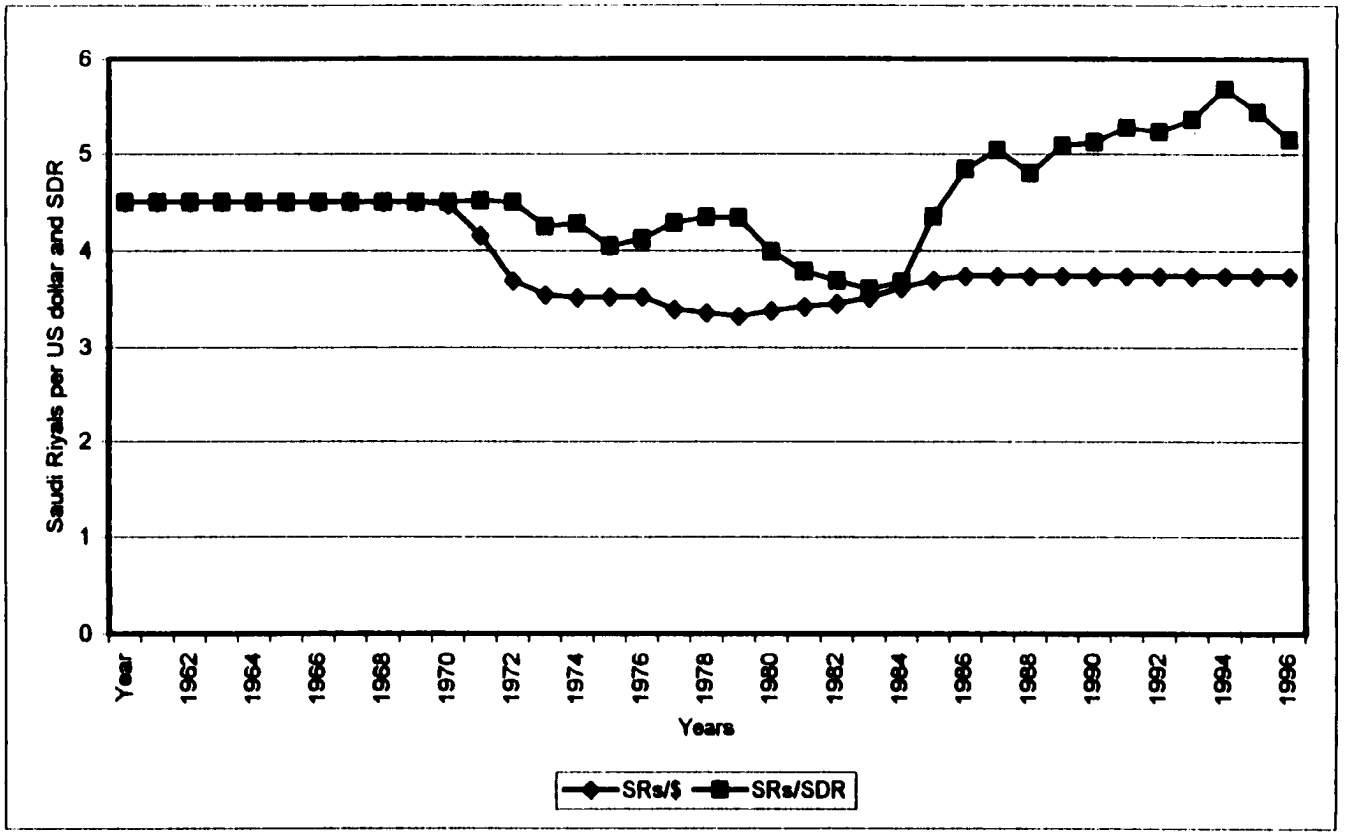

Figure 3.9: Saudi riyal per US dollar and SDR.

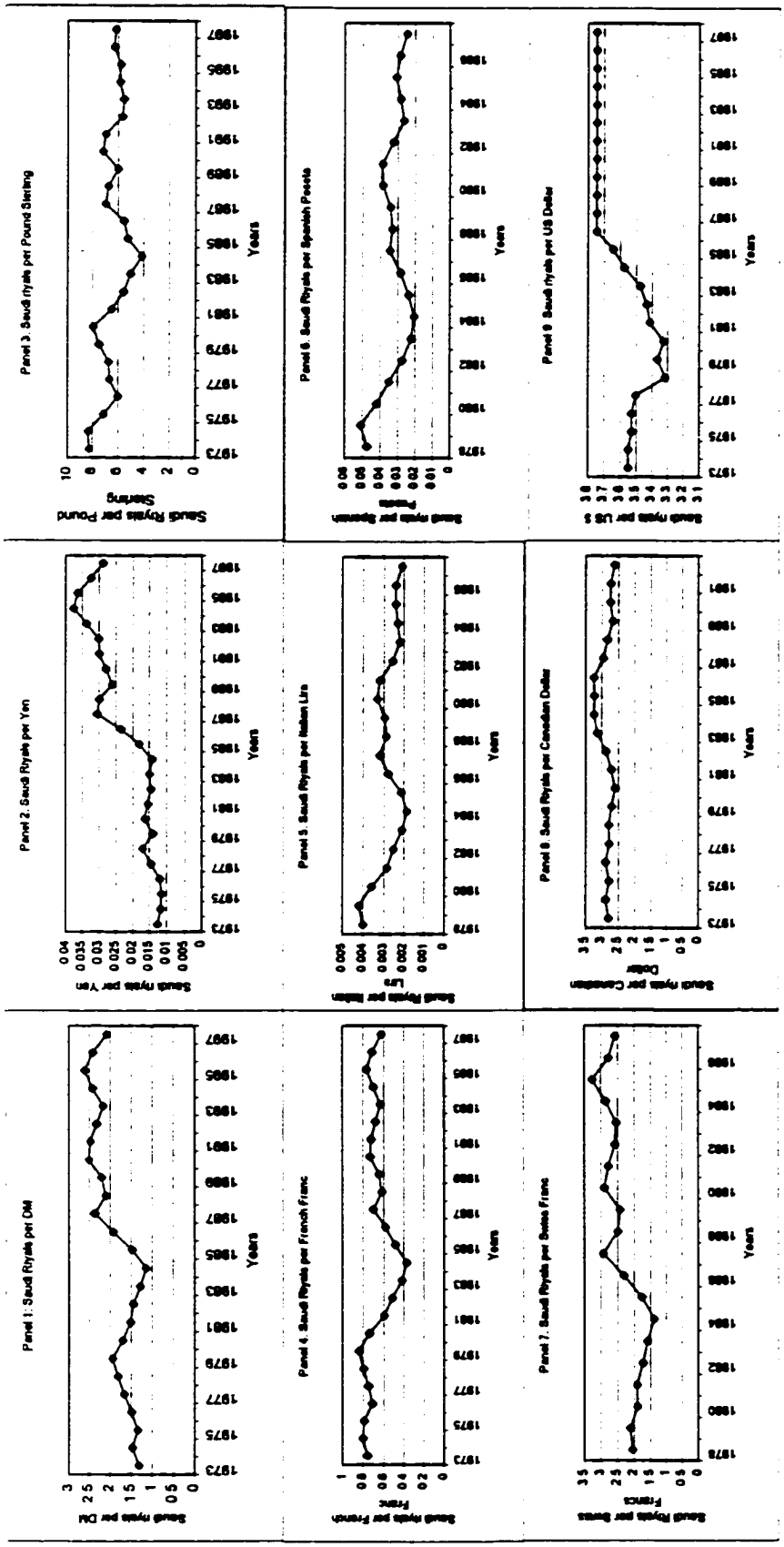

Figure 3.10: Saudi riyal exchange rate against major currencies.

depreciated to SR 2.6125 per DM, which represents about a 131 percent fall relative to the peak year of 1984.

Relative to the Yen, the riyal appreciated between 1973 and 1975 and then depreciated substantially between 1975 and 1980 by about 23 percent. The riyal again appreciated against the Yen between 1981 and 1984 (see Figure 3.10, panel 2). After 1984, the riyal started a general depreciation trend against the Yen until 1994. One Saudi riyal was equivalent to only 26.67 Yen, the lowest level ever over the preceding 22 years, with a depreciation of more than 66 percent compared to the 1973 level. After 1994 the riyal began to recover against the Yen with an exchange rate of 34.72 Yen per Saudi riyal in 1997.

Relative to the British pound, the riyal appreciated between 1974 and 1976, but then depreciated during 1977 to1980. Between 1980 and 1984, the riyal appreciated dramatically against the pound, such that its 1984 exchange rate was SR 4.1345 per pound compared to SR 8.2474 per pound in 1973, a 50 percent appreciation (see Table A3.14 and panel 3 of Figure 3.10). It depreciated once more between 1984 and 1987. By 1987, the riyal held about 30 percent of its 1984 value against the British pound. (a depreciation of about 70 percent). The riyal again fluctuated between 1987 and 1992. After this, its fluctuations vis-à-vis the pound were less pronounced. By 1997, the pound was equivalent to 6.19 Saudi riyals compared with SR 8.25 in 1973.

Relative to the French franc, the riyal fluctuated upward and downward between 1973 and 1979. Between 1979 and 1984, the riyal appreciated strongly against the French franc, reaching 2.68 francs per riyal in 1984 (a 125 percent appreciation over the 1979

level). It depreciated again between 1984 and 1987 and fluctuated further through 1997 (see panel 4 Figure 3.10).

With respect to the Italian lira, the Saudi riyal appreciated dramatically between 1979 and 1984. The riyal was equal to lira 540.54 in 1984, compared to 238.66 lira in 1979, a 127 percent appreciation. It then depreciated against the lira during the period of 1984 to 1987. Subsequently, the riyal has continued to fluctuate up and down against the lira through 1997 (panel 5 of Figure 3.10).

Relative to the Spanish Peseta, the riyal appreciated dramatically by 147 percent during the period of 1979 to 1984. It then depreciated until 1987 after which it continued to fluctuate up and down. By 1997 its exchange rate was 40.49 Pesetas per one Saudi riyal (compared with 21.14 Pesetas in 1978) (panel 6, Figure 3.10).

Relative to the Swiss franc, the riyal first appreciated by 32 percent during the period 1978 to 1984, then depreciated between 1984 and 1987. Subsequently it has fluctuated up and down for the rest of the period until 1997 (panel 7, Figure 3.10).

Over the entire period of 1973-1997, the Saudi riyal appreciated vis-à-vis the French franc by 21 percent relative to 1973. It also appreciated against the British pound by 25 percent, the Italian lira by 90 percent, and the Spanish Peseta by 92 percent. It depreciated, however, against the Japanese Yen (56 percent), Deutch Mark (59 percent), US dollar (5.5 percent), Swiss Franc (26 percent) and SDR (20.3 percent).

SUMMARY AND CONCLUSIONS

As we have seen, the Saudi economy is dominated by the oil sector. The overall performance of the Saudi economy has been largely a reflection of the conditions of the oil sector. Given the major contribution of oil to total GDP, wildly fluctuating growth rates in the oil sector, caused by instability in the world oil market, are reflected in the growth rates of the economy. As a developing economy, Saudi Arabia depends heavily on both exports and imports. On the exports side, the majority of Saudi exports is directed toward Western Europe, the USA, and Japan. The Asian countries become the leading importers of Saudi exports, mainly oil, since 1982.

Imports, on the other side, are also affected, although indirectly, by fluctuations in the oil sector. These fluctuations, therefore, affect the oil revenues, government spending, and, consequently, domestic consumption. These in turn adversely affect import levels.

Concerning the exchange rate policy, Saudi Arabia chose to peg its currency, the riyal, to the SDR in 1975 when it was found that fixing the riyal to the US dollar was not the optimal policy. The riyal remained pegged to the SDR until late 1986, when it was re-pegged to the US dollar and remains so to this day. As a result of this policy, the riyal exchange rates vis-à-vis all other major currencies have been subject to unnecessary fluctuations which have their impact on the economy. It is these fluctuations of the Saudi riyal against the currencies of the major industrial countries and their impact on the Saudi trade flows that will be empirically investigated in the following chapter.

CHAPTER FOUR

THE MODELS SPECIFICATION, METHODOLOGY AND EMPIRICAL RESULTS

INTRODUCTION

As mentioned in chapter one, the purpose of this study is to investigate the impact of exchange rate fluctuations on the trade flows of Saudi Arabia. This will be accomplished by estimating both aggregate and disaggregate export and import demand functions for Saudi Arabia's trade flows. Using annual data on the relevant variables and applying OLS techniques, the models are estimated over the period 1973 through 1995. We chose to begin our study with 1973 because this date corresponds to the time of the formal abandonment of the Bretton-Woods regime of fixed exchange rates.

What follows is a brief description of our models. For the purpose of this study, we assume that Saudi Arabia is a price taker on world markets with respect to its imports and exports. This assumption supports the use of single-equation techniques for estimating both aggregate as well as bilateral trade flows (imports and exports). We begin with aggregate export demand function followed by aggregate import demand equation. This is followed by a description of the bilateral trade flows models, both bilateral exports and imports and the chapter ends with a summary of the results.

AGGREGATE EXPORT DEMAND FUNCTION

Following existing empirical literature in this area, the world demand for a country's aggregate exports is specified in log-linear terms as:

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + U_t \quad \text{..... (4.1)}$$

Where:

X = volume of exports,

YW = index of World GDP, 1990 = 100,

PX = export prices, 1987 = 100,

PXW = export unit values for the industrial countries, 1990 = 100,

U = error term.

Since the introduction of the floating exchange rate system in the early 1970s, demand equations without an exchange rate variable were no longer considered to be complete models for analyzing trade flows. This is because under the floating exchange rate, both importers and exporters are exposed to exchange risk. For this reason, and since it is our purpose to assess the effect of exchange rate fluctuations on the trade flows of Saudi Arabia, both an exchange rate variable and a measure of exchange rate risk were added. With this modification, equation (4.1) can be rewritten as follows:

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + a_3 \ln EX_t + a_4 \ln SDEX_t + U_t \quad \text{.....(4.2)}$$

Where:

EX = a measure of effective exchange rate,

SDEX = a measure of exchange rate risk.

Since equation (4.2) is specified in logarithms, a_1 and a_2 are world income and relative price elasticities of export demand, respectively. If foreign income rises, the

demand for Saudi exports will rise, so a_1 is expected to be positive. On the other hand, if relative prices rise, the demand for exports will fall, so a_2 is expected to be negative. Since EX, the exchange rate variable is defined as units of foreign currency per Saudi riyal, it is expected that a_3 will be negative, indicating that appreciation of domestic currency (Saudi riyal) discourages exports. Regarding the effects of exchange rate variability measure, SDEX, on trade flows, "it has been argued that the higher volatility of exchange rates will hamper trade flows by creating uncertainty about the profits to be made from international trade transactions." (Arize, 1995, P.39). Therefore, a_4 in equation (4.2) is expected to be negative. In summary, we would expect that, in equation (4.2), $a_1>0$; $a_2< 0$; $a_3<0$; and $a_4<0$.

ADDITIONAL EXPLANATORY VARIABLES

Since the Organization of Petroleum Exporting Countries, OPEC, plays the role of the residual producer in the world oil market, and since Saudi Arabia plays a major role within OPEC, a new variable, OILGAP is to be included in our model. This new variable, OILGAP, is defined as the difference between total world demand for oil and the supply of oil from non-OPEC countries (Pindyck, 1979). As the gap between world oil demand and non-OPEC oil supply widens, the demand for Saudi exports, mainly crude oil, increases. To this effect, the expected sign of the coefficient of this variable is positive.

Another explanatory variable that was added to our model is a dummy variable to account for a switch in Saudi exchange rate policy. As mentioned in Chapter 3, Saudi Arabia, officially, switched back to a dollar-peg in 1987, and the Saudi riyal remains

pegged to the U.S. dollar until the present. The new variable is DVEX. If this switch in policy would prove to be harmful to the Saudi trade flows, the expected sign of its coefficient would be negative.

Unusual events such as the first and second oil price shocks, which are expected to influence trade flows, are accounted for by applying an additional dummy variable, DV1.

To sum up, the "complete" model specification is:

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + a_3 \ln EX_t + a_4 \ln SDEX_t + a_5 \ln (OILGAP)_t + a_6 DVEX_t + a_7 DV1_t + U_t \quad \text{.....(4.3)}$$

Where the variables X_t, YW_t, $(PX/PXW)_t$, EX_t, $SDEX_t$, $OILGAP_t$, and $DVEX_t$ have been previously defined and the expected coefficients signs as follows: $a_1>0$; $a_2<0$; $a_3<0$; $a_4<0$; $a_5>0$; and $a_6<0$; $a_7>0$.

AGGREGATE IMPORT DEMAND FUNCTION

Standard trade theory tells us that the simplest formulation of an aggregate import demand equation is to regress the quantity of imports demanded by a country on the ratio of its import prices to domestic prices (assuming a degree of substitutability between imports and domestically produced goods) and on domestic real income, all in period t. So the aggregate import equation for Saudi Arabia could be expressed, in log-linear form as follows:

$$\ln M_t = b_0 + b_1 \ln Y_t + b_2 \ln (PM/PD)_t + U_t \quad \text{.....(4.4)}$$

However, since it is our purpose in this study to assess the effect of exchange rate on trade flows of Saudi Arabia, an exchange rate variable along with a measure of

exchange rate risk would be added, so equation (4.4) can be rewritten, to reflect this modification as:

$$\ln M_t = b_0 + b_1 \ln Y_t + b_2 \ln (PM/PD)_t + b_3 \ln EX_t + b_4 \ln SDEX_t + U_t \ldots\ldots\ldots\ldots (4.5)$$

Where:

Mt = import volume at time t,

PM = import prices,

PD = domestic price level,

Y = domestic real income,

EX = a measure of effective exchange rate,

SDEX = a measure of exchange rate risk,

U = error term.

Since equation (4.5) is specified in logarithms, b_1 and b_2 are the income and relative price elasticities of import demand, respectively. It is expected that b_1 will be positive and b_2 is negative.

Since EX, in this model, is defined as number of units of foreign currency per unit of domestic currency, the expected sign of the EX parameter is positive. An increase in EX implies an appreciation of Saudi riyal which is expected to exert a positive effect on imports. Regarding the effects of exchange rate risk, SDEX, the expected sign of b_4 is negative, an increase in exchange rate risk would affect trade flows negatively. In summary, we would expect that $b_1>0$; $b_2<0$; $b_3>0$; and $b_4<0$.

As mentioned before, the switch of Saudi exchange policy to a dollar-peg will be accounted for by adding a dummy variable, DVEX, with an expected negative sign, and equation (4.5) can be rewritten as:

$$\ln M_t = b_0 + b_1 \ln Y_t + b_2 \ln (PM/PD)_t + b_3 \ln EX_t + b_4 \ln SDEX_t + b_5 DVEX + U_t \quad ...(4.6)$$

Where M, PM, PD, Y, EX, SDEX and DVEX have been previously defined and the expected signs of the parameters in equation (4.6) as follows:

$b_1>0$; $b_2<0$; $b_3>0$; $b_4<0$ and $b_5<0$.

DISAGGREGATE EXPORT DEMAND FUNCTIONS

To specify an empirical model for Saudi Arabia's bilateral trade flows, we will apply a traditional export demand function with the addition of the exchange rate variable and a measure of exchange rate risk. So disaggregate exports of Saudi Arabia to country i can be written, in log-linear form, as:

$$\ln X_{it} = c_0 + c_1 \ln Y_{it} + c_2 \ln (PXSA/PM_i)_t + c_3 \ln EXi_t + c_4 SDEX_t + c_5 DVEX + U_t \quad ...(4.7)$$

Where:

X_{it} = real Saudi exports demanded in country i at time t,

Y_{it} = real income (GDP) in country i,

$PXSA_t$ = the exports price of Saudi Arabia,

PM_{it} = the import price of country i,

EXi_t = a measure of bilateral exchange rate between currency i and the U.S. dollar,

$SDEX_t$ = standard deviation of the exchange rate, EXi,

DVEX = a dummy variable representing the switch of the Saudi exchange rate regime to the dollar-peg,

U_t = error term.

Since all variables, except SDEX and DVEX, are expressed as logs, their coefficients, except c_4 and c_5, give the usual elasticities. In the case of Saudi exports it is

expected that as the foreign economy i grows, it would demand more Saudi exports (mainly oil), so the expected sign of c_1 is positive. As the price of Saudi exports rises relative to that of the importing country, Saudi exports become less competitive so the expected sign of c_2 is negative.

Defined as units of foreign currency i per U.S. dollar, the expected sign of the coefficient of EX is negative (i.e., $c_3<0$). That is to say as the foreign currency i depreciates vis-a-vis the U.S. dollar the demand of country i for Saudi exports will be less. The sign of the effect of exchange rate variability (SDEX) on trade flows is expected to be negative. One can expect that an increase in exchange rate variability between currency i and the dollar will negatively affect trade flows between country i and Saudi Arabia. Similarly, if the change of exchange rate policy of Saudi Arabia (DVEX) exert an adverse effect on Saudi exports, the sign of c_5 would be negative. In summary, it is expected that $c_1>0$; $c_2<0$; $c_3<0$; $c_4<0$, and $c_5<0$.

DISAGGREGATE IMPORT DEMAND FUNCTIONS

To test whether exchange rate volatility has an adverse effect on the volume of Saudi imports from its trading partners, the disaggregate import demand function can be specified as follows:

$$\ln M_{it} = d_0 + d_1 \ln Y_t + d_2 \ln (PX_i/PD)_t + d_3 \ln EXi_t + d_4 SDEXi_t + d_5 DVEX + d_6 TOT + U_t \quad \text{.....(4.8)}$$

Where

M_{it} = real Saudi imports from country i at time t,

Y_t = real Saudi GDP,

PX_i = price of exports in country i,

PD = Saudi domestic price level,

EXi_t = Saudi riyal exchange rate, defined as units of Saudi riyal per unit of currency i,

$SDEXi_t$ = standard deviations of EXit,

DVEX = a dummy variable previously defined,

TOT = Saudi terms of trade.

Since equation (4.8) is expressed in log-linear terms, with the exception of SDEX and DVEX, the coefficients are interpreted as elasticities. It is expected that as the Saudi economy grows, its imports from its trading partners increase, so d_1 is positive. With respect to the relative price term, it is expected that as the price level of the exporting country i rises relative to the Saudi domestic price, its goods become less competitive so d_2 would be negative. Defined as Saudi riyals per foreign currency i, EX variable is expected to carry a negative coefficient (i.e., $d_3<0$). An increases in EX implies a depreciating Saudi riyal against currency i, which in turn leads to lower imports from country i.

Exchange rate risk, represented by SDEX, is expected to carry a negative sign (i.e., $d_4<0$). If the change of exchange regime to the U.S. dollar-peg adversely affect Saudi imports from country i, then the expected sign of DVEX is negative (i.e., $d_5<0$). Finally, the terms of trade variable, TOT; defined as the relative price of Saudi exports to the price of its imports; is expected to carry a positive sign. This would indicate that an increase in TOT, which implies a higher purchasing power, would lead to higher imports from country i.

EXCHANGE RATE MEASURES

Before we present the empirical results of our models, it is necessary to shed some light on the concepts of both exchange rate and the measures of exchange rate risk used in this study. As the empirical work on this area of international trade flows has evolved, a number of important issues have arisen. Among these issues is the definition of the exchange rate employed in the literature. Although economists generally agree that some measure of exchange rate should be included in models which try to test for the effect of exchange rate volatility on trade flows, there is no consensus on whether to use nominal exchange rates or real exchange rates. The use of real exchange rates is "advocated primarily because it takes into account the possible offsetting nature of price movements to nominal exchange rate changes" (Medhora, 1990, P. 315).

Among those who used the concept of real exchange rate are Arize (1996, 1997, 1998), Caporale and Doroodian (1994), Cushman (1983, 1986), Gotur (1985), IMFC (1984), and Kenen and Rodrik (1984, 1986). Conversely, Akhtar and Hilton (1984), Bailey, et. al. (1986), Bini-Smaghi (1991), Hooper and Kohlhagen (1978), Kumar and Dhawan (1991), Medhora (1990), and Thursby and Thursby (1985, 1987) are among those who employed a concept of a nominal exchange rate. Given the choice of nominal or real exchange rates, the second issue involved in assessing the impact of exchange rate variability on trade flows is the choice of the statistical measure of exchange rate variability. Various statistical measures of variability have been used in the literature, namely: (1) the standard deviation of the levels of exchange rates or of the changes in these rates, (2) deviations from trend, (3) the difference between previous forward and

current spot rates, (4) the Gini mean difference coefficient, (5) the coefficient of variation, (6) the scale of measure of variability, and (7) a GARCH measure of exchange rate uncertainty.

Akhtar and Hilton (1984), for example, employed the standard deviation of indices of nominal effective exchange rates as a measure of exchange rate volatility (Akhtar and Hilton, 1984, P.13). Arize (1996, 1997, 1998), on the other hand, used two measures of exchange rate uncertainty. The first measure was an eight-term moving average deviation, of real effective exchange rate observations, around the predicted values of exchange rate. The second measure was obtained in a similar fashion, using the predicted values of the change in real effective exchange rate between two consecutive quarters (Arize, 1998, P.421). Bahmani-Oskooee (1991, 1993, 1996) used nominal, real or both measures of exchange rate volatility. The variability measure they employed was the standard deviation of quarterly percentage changes in exchange rate (either nominal or real) over the eight previous quarters (Bahmani-Oskooee 1993, P.193). Bailey et. al. (1987) used a polynomial distributed log of the absolute value of the quarter-to-quarter percentage change in the exporting country's effective exchange rates (he tested for the effects of both nominal and real exchange rate volatility). Caporale and Doroodian (1994) employed a GARCH measure of exchange rate uncertainty using real exchange rate. They focus on the real exchange rate rather than nominal "because it takes into account the offsetting nature of price movements to nominal exchange rate changes and because trade flows are affected by real exchange rates." (Caporale and Doroodian, 1994, P.51). Cushman (1988) used a four-quarter moving mean of recent quarterly percentage changes in real exchange rate constructed from deviations around the recent observed mean of

such changes. He also used another measure, which is constructed from a twelve-month moving standard deviation of recent monthly real exchange rate changes.

DeGrauwe (1988) used the yearly percentage changes of the bilateral exchange rate between currency i and currency j around the mean observed during period t as a measure of the variability of exchange rates. He concluded that "it is mainly through the variability of the real exchange rates that international trade flows are likely to be affected." (DeGrauwe, 1988, P.71). Medhora (1990) argued that it is the nominal rather than real variability of exchange rates that is more relevant to economic agents and he used the standard deviation of spot rates of the nominal effective exchange rate as the most appropriate measure to use.

Most of the preceding studies, which attempted to study the effect of exchange rate variability on trade flows, employed the concept of effective exchange rate, whether in nominal or real form. To construct this variable for Saudi Arabia, we will follow the four steps used by Bahmani-Oskooee (1992). First, We need the bilateral exchange rates between the Saudi riyal and the currencies of Saudi Arabia's trading partners. These rates are not directly available, and so had to be calculated using the dollar exchange rate vis-a-vis other major currencies and the exchange rate of the Saudi riyal against the US dollar. The bilateral rates are denoted as EX_{ij}'s, and defined as the number of Saudi riyals per unit of j's currency. In the second step, the real bilateral exchange rates are calculated using EX_{ij}'s and CPI indexes (1990=100) as follows:

$REX_{ij} = (CPI_j * EX_{ij}/CPI_i)$, $i \neq j$ where CPI_j is country j's price level, CPI_i is the price level of Saudi Arabia, and REX_{ij} is the real bilateral exchange rate of Saudi Arabia defined as units of riyal per unit of j's currency. The third step involves making these real

bilateral exchange rates homogenous across all trading partners. This is done, again, following Bahmani-Oskooee (1992), by setting the real bilateral exchange rates in index form. Thus, denoting the index of real bilateral exchange rates by $IREX_{ij}$ and selecting 1990 as the base year, we have:

$$IREX_{ij} = (REX^{t}_{ij}/REX^{90}_{ij}) * 100$$

Finally, we need to take the weighted average of IREXij in order to obtain the index of real effective exchange rate for Saudi Arabia, which we denote by REER, thus:

$$REER = \sum_{i=1}^{n} \alpha_{ij} \, IREX_{ij}$$

where α_{ij} is the share of country j's import or export in Saudi Arabia's total trade in the base year 1990 and $\Sigma \alpha_{ij} = 1$.

To construct the nominal effective exchange rate (NEER) for Saudi Arabia, we follow the same four steps mentioned but we drop the price levels from the second step above. It should be noted that the definition of EX_{ij}, units of Saudi riyal per unit of j's currency, dictates the definition of REER and NEER. Therefore, based on our definition of EXij, a decrease (increase) in REER or NEER reflects appreciation (depreciation) of the Saudi riyal.

Besides the use of NEER and REER, this study will also employ a measure of dollar effective exchange rate. This measure is the trade-weighted dollar exchange rate, which is a weighted average of the foreign exchange values of the U.S. dollar against the currencies of the other G-10 countries (Federal Reserve Bulletin, 1998). Because of the way this index is constructed (foreign currency price of the U.S. dollar) an increase in this index implies an appreciation of the U.S. dollar. Among those who have used this

index is Asr (1992). He argued that the choice of an effective exchange rate of the dollar is based on the fact that "[Saudi] exports are almost entirely invoiced in dollars, no matter where the export commodities are destined, while [its] imports could be settled in terms of almost any convertible currency" (Asr, 1992, P.99). For this reason, and "since petroleum is priced in terms of U.S. dollars on [international] markets, its price for non-U.S. markets is directly sensitive to changes in the dollar exchange rate. Consequently, for countries other than the U.S., the home currency prices of petroleum vary directly with the exchange value of the U.S. dollar against their domestic currencies." (Asr, 1992, P.67).

EMPIRICAL RESULTS

The empirical results of our models, discussed in the previous section, are presented in this section. In particular, Equations (4.3), (4.6), (4.7) and (4.8) are estimated over the period 1973 through 1995, using the method of ordinary least squares (OLS). Corrections for first- and/or second-autocorrelation were made when it was deemed to be necessary.

RESULTS OF THE ESTIMATES OF AGGREGATE EXPORT DEMAND

Table (4.1) presents the results of the estimate of the aggregate Saudi export demand function (Equation 4.3). Several forms of Equation (4.3) are estimated. Model A1 is an estimate of the Equation using the trade-weighted dollar effective exchange rate. Model A2 is similar to Model A1 except that it drops the relative price term from the

Table (4.1): Results of the estimates of aggregate export demand function (equation 4.3)

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + a_3 \ln EX_t + a_4 \ln SDEX_t + a_5 \ln (OILGAP)_t + a_6 DVEX_t + a_7 DV1_t + U_t$$

	YW	PX/PXW	EX	SDEX	OILGAP	DVEX	DV1	R-sq.	Adj-R-sq.	D.W.	F-Test	n
Exp. Sign	+	-	-	-	+	-	+					
Model A1	0.45	-0.14	-0.82	0.027	1.41	-0.31	0.002	0.98	0.96	2.1	55.46	19
T-stat.	2.98	2.07	2.73	0.48	5.87	5.91	0.02					
Sig. Level	***	**	***		***	***						
No. of Lags	2	2	1	2	0	0	0					
Model A2	0.3		-0.42	-0.008	1.86	-0.23	0.16	0.98	0.96	2.36	59.67	21
T-stat.	1.89		1.32	0.24	8.85	4.35	2.7					
Sig. Level	**				***	***	***					
No. of Lags	2		1	1	0	0	0					
Model B1	0.92	-0.03	-2.17	-0.04	1.7	-0.13	0.2	0.98	0.97	2.38	65.74	21
T-stat.	3.67	0.52	2.17	1.8	8.95	1.9	4.58					
Sig. Level	***		**	**	***	**	***					
No. of Lags	2	2	2	1	0	0	0					
Model B2	0.59		-1.31	-0.03	1.84	-0.14	0.2	0.98	0.97	2.17	79.23	23
T-stat.	3.12		1.59	2.51	11.67	2.02	5.22					
Sig. Level	***		*	**	***	**	***					
No. of Lags	2		2	1	0	0	0					

Table (4.1): Results of the estimates of aggregate export demand function (equation 4.3)

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + a_3 \ln EX_t + a_4 \ln SDEX_t + a_5 \ln (OILGAP)_t + a_6 DVEX_t + a_7 DV1_t + U_t$$

	YW	PX/PXW	EX	SDEX	OILGAP	DVEX	DV1	R-sq.	Adj-R-sq.	D.W.	F-Test	n
Exp. Sign	+	-	-	-	+	-	+					
Model A1	0.45	-0.14	-0.82	0.027	1.41	-0.31	0.002	0.98	0.96	2.1	55.46	19
T-stat.	2.98	2.07	2.73	0.48	5.87	5.91	0.02					
Sig. Level	***	**	***		***	***						
No. of Lags	2	2	1	2	0	0	0					
Model A2	0.3		-0.42	-0.008	1.86	-0.23	0.16	0.98	0.96	2.36	59.67	21
T-stat.	1.89		1.32	0.24	8.85	4.35	2.7					
Sig. Level	**				***	***	***					
No. of Lags	2		1	1	0	0	0					
Model B1	0.92	-0.03	-2.17	-0.04	1.7	-0.13	0.2	0.98	0.97	2.38	65.74	21
T-stat.	3.67	0.52	2.17	1.8	8.95	1.9	4.58					
Sig. Level	***		**	**	***	**	***					
No. of Lags	2	2	2	1	0	0	0					
Model B2	0.59		-1.31	-0.03	1.84	-0.14	0.2	0.98	0.97	2.17	79.23	23
T-stat.	3.12		1.59	2.51	11.67	2.02	5.22					
Sig. Level	***		*	**	***	**	***					
No. of Lags	2		2	1	0	0	0					

Table (4.1): Results of the estimates of aggregate export demand function (equation 4.3)

$$\ln X_t = a_0 + a_1 \ln YW_t + a_2 \ln (PX/PXW)_t + a_3 \ln EX_t + a_4 \ln SDEX_t + a_5 \ln (OILGAP)_t + a_6 DVEX_t + a_7 DV1_t + U_t$$

	YW	PX/PXW	EX	SDEX	OILGAP	DVEX	DV1	R-sq.	Adj-R-sq.	D.W.	F-Test	n
Exp. Sign	+	-	-	-	+	-	+					
Model A1	0.45	-0.14	-0.82	0.027	1.41	-0.31	0.002	0.98	0.96	2.1	55.46	19
T-stat.	2.98	2.07	2.73	0.48	5.87	5.91	0.02					
Sig. Level	***	**	***		***	***						
No. of Lags	2	2	1	2	0	0	0					
Model A2	0.3		-0.42	-0.008	1.86	-0.23	0.16	0.98	0.96	2.36	59.67	21
T-stat.	1.89		1.32	0.24	8.85	4.35	2.7					
Sig. Level	**				***	***	***					
No. of Lags	2		1	1	0	0	0					
Model B1	0.92	-0.03	-2.17	-0.04	1.7	-0.13	0.2	0.98	0.97	2.38	65.74	21
T-stat.	3.67	0.52	2.17	1.8	8.95	1.9	4.58					
Sig. Level	***		**	**	***	**	***					
No. of Lags	2	2	2	1	0	0	0					
Model B2	0.59		-1.31	-0.03	1.84	-0.14	0.2	0.98	0.97	2.17	79.23	23
T-stat.	3.12		1.59	2.51	11.67	2.02	5.22					
Sig. Level	***		*	**	***	**	***					
No. of Lags	2		2	1	0	0	0					

estimation. This is a very common practice in the literature, either to include both the relative price and exchange rate terms or just one of them. Model B1 uses a different measure of effective exchange rate for Saudi Arabia. It uses the nominal effective exchange rate NEER, for Saudi Arabia, as calculated by the author. Model B2, on the other hand, is the same as the previous one except that the relative price term is dropped from the estimation. Model C1 applies the real effective exchange rate measure (REER), again calculated by the author, while Model C2 uses the same REER without the price term. Models D and E use the NEER and REER, respectively. These measures are calculated by Bahmani-Oskooee (1998). While Models D1 and E1 are estimated with a price term, Models D2 and E2 are estimated without it.

Careful examination of Table (4.1) reveals the following points. First, world income, YW, has the expected positive sign in all ten models and is statistically significant in all but two cases. Second, the relative price term (PX/PXW) has the expected negative sign in all five cases where the price term was included. Third, oil gap term, OILGAP, has the expected positive sign in every case and is statistically significant, at one percent significant level, in all ten cases. Fourth, the dummy variable, DV1, which represents the unusual events of higher oil prices, has the expected positive sign in all ten cases and is statistically significant in all but three cases.

Turning now to the exchange rate terms, EX, SDEX, and DVEX, it is clear from Table (4.1) that the exchange rate variable (EX) has the expected negative sign in all models except in Model E. It is significant in six out of ten cases. This suggests that an appreciation of the Saudi riyal will lead to, other things being equal, a decrease in Saudi exports; likewise, a depreciation of Saudi riyal would stimulate exports. Regarding the

exchange rate risk variable, SDEX, it has the expected negative sign in all but two cases. In four cases, it is statistically different from zero at either the one or five percent significance levels. The impact of the exchange rate policy switch to the dollar-peg, which is captured by the dummy variable DVEX, is shown to be negative in all ten cases. These results are very suggestive that pegging Saudi riyal to the dollar has proven to be harmful to Saudi exports. The general conclusion that can be drawn from Table (4.1) is that exchange rate variability has proven to be harmful to the Saudi exports.

RESULTS OF THE ESTIMATES OF AGGREGATE IMPORT DEMAND

The results of the estimated aggregate import demand for Saudi Arabia are reported in Table (4.2) which shows the coefficient estimates for each variable using several exchange rate measures. Regardless of which measure of exchange rate we use, the results of our estimates are in general conformity with our prior expectations, and are significant in almost all cases. Model A, for example, uses the dollar-effective exchange rate and all coefficients have their expected signs and are all significant at the one percent level of significance, except SDEX and DVEX which are significant at the five and ten percent levels, respectively. Models B and C use different exchange rate measures. Model B uses Bahmani-Oskooee's effective exchange rate, EER, both nominal and real, while Model C uses the EER, both nominal and real, constructed by the author.

Across all models, the estimated income elasticities are positive and statistically different from zero at the one percent level. Moreover, these elasticities are all above unity (they range from 2.26 in Model B1 to 3.54 in Model A). This implies that an

Table (4.2): Results of the estimates of aggregate import demand function (equation 4.6)

$$\ln M_t = b_0 + b_1 \ln (PM/PD)_t + b_2 \ln Y_t + b_3 \ln EX_t + b_4 \ln SDEX_t + b_5 DVEX + U_t \ldots\ldots (4.6)$$

	Y	PM/PD	EX	SDEX	DVEX	R-sq.	Adj-R-sq.	D.W.	F-Test	n
Exp. Sign	+	-	+	-	-					
Model A	3.54	-0.78	1.09	-0.16	-0.15	0.98	0.96	2	72.87	20
T-stat.	21.9	3.03	3.31	1.87	1.51					
Sig. Level	***	***	***	**	*					
No. of lags	0	1	0	1	0					
Model B1	2.26	-1.47	-1.14	-0.24	-0.04	0.8	0.63	2.37	4.58	16
T-stat.	5.21	1.84	2.45	2.95	0.21					
Sig. Level	***	**	**	***						
No. of lags	2	1	1	1	0					
Model B2	2.74	-0.86	1.51	-0.17	0.64	0.93	0.87	2.59	15.57	16
T-stat.	5.9	2.14	6.23	4.29	4.71					
Sig. Level	***	**	***	***	***					
No. of lags	0	1	0	1	0					

Table (4.2): Results of the estimates of aggregate import demand function (equation 4.6)

$$\ln M_t = b_0 + b_1 \ln (PM/PD)_t + b_2 \ln Y_t + b_3 \ln EX_t + b_4 \ln SDEX_t + b_5 DVEX + U_t \ldots\ldots (4.6)$$

	Y	PM/PD	EX	SDEX	DVEX	R-sq.	Adj-R-sq.	D.W.	F-Test	n
Exp. Sign	+	-	+	-	-					
Model A	3.54	-0.78	1.09	-0.16	-0.15	0.98	0.96	2	72.87	20
T-stat.	21.9	3.03	3.31	1.87	1.51					
Sig. Level	***	***	***	**	*					
No. of lags	0	1	0	1	0					
Model B1	2.26	-1.47	-1.14	-0.24	-0.04	0.8	0.63	2.37	4.58	16
T-stat.	5.21	1.84	2.45	2.95	0.21					
Sig. Level	***	**	**	***						
No. of lags	2	1	1	1	0					
Model B2	2.74	-0.86	1.51	-0.17	0.64	0.93	0.87	2.59	15.57	16
T-stat.	5.9	2.14	6.23	4.29	4.71					
Sig. Level	***	**	***	***	***					
No. of lags	0	1	0	1	0					

increase in real Saudi GDP by one percent will cause, other things being equal, an increase in imports by 3.5 percent, as indicated by Model A, or 2.26 percent, as indicated by Model B1. The estimated price elasticities are all have the expected negative signs and all are significant at the one percent or five percent levels of significance. This enables us to conclude that relative prices of imports have a significant impact on the aggregate import demand of Saudi Arabia.

As far as the exchange rate variable, EX, is concerned, its elasticity also has the expected sign in all models except one. In Model A, EX was expected to carry a positive sign, indicating that an appreciation of the dollar, which means a higher purchasing power for Saudi income, would lead to higher imports. Put differently, as the dollar depreciates in real term by one percent, Saudi imports would fall by about one percent. Model C1 which employs a different nominal effective exchange rate for Saudi Arabia, has an exchange rate elasticity of 5.67. This means as the Saudi riyal depreciates by one percent, total imports would fall by about five percent. Estimated elasticities with respect to exchange rate risk, SDEX, also have the expected negative signs all but one case and are significantly different from zero in four out of five cases. Finally, the shift in exchange rate policy (re-peg to the U.S. dollar), as represented by the dummy variable DVEX has the expected negative sign in three models out of five. All in all, we can conclude that exchange rate variability has an adverse effect on the aggregate Saudi imports.

Let us now present the results of our estimate of the bilateral trade (both export and import) flows of Saudi Arabia with a number of its major trading partners.

RESULTS OF THE ESTIMATES OF THE DISAGGREGATE EXPORT DEMAND

The results of Equation (4.7), which represents the bilateral exports of Saudi Arabia to a number of its trading partners, are presented in Table (4.3). These bilateral trade flows are estimated for the following countries: France, Germany, Italy, Japan, South Korea, Singapore, Spain, the United Kingdom, and the United States. Taken together, these countries received more than 60 percent of the total Saudi exports in 1995. As Table (4.3) shows, the estimated foreign income elasticities have, in general, the expected positive signs in five out of nine cases, and significantly differ from zero in all these five cases. This is to say that as foreign income increases, it demands more Saudi exports. These elasticities range from two, in the case of France, to five in the case of Italy. Therefore, it is safe to conclude that as the incomes of the Saudi trade partners grow, they will demand more Saudi exports, mainly oil. Table (4.3) also reveals that the relative price term, PXSA/PMi, carries its significant negative coefficient in all but one case. The relative price elasticities range from -1.46 in the case of the US, to -0.18 in the case of Singapore. Taking the equation for the US as an example, an increase in relative price by one percent will generate a decrease in Saudi exports to that country by about 1.5 percent. Although the magnitude of these price elasticities varies among the countries, the general conclusion is that an increase in Saudi relative price would lead to fewer exports.

Turning now to the exchange rate variable, EX, we can see that it has the expected negative sign in all cases and is significantly different from zero in all but

Table (4.3): Results of the estimates of the disaggregate export demand (equation 4.7)

$$\ln X_{it} = c_0 + c_1 \ln Y_{it} + c_2 \ln (PXSA/PM_i)_t + c_3 \ln EX_t + c_4 SDEX_t + c_5 DVEX + U_t \ldots (4.7)$$

Country	Y	PXSA/Pmi	EX	SDEX	DVEX	R-sq.	Adj-R-sq.	D.W.	F-test	n
Exp. Sign	+	-	-	-	-					
France	2	-0.49	-2.6	-1.23	-1.14	0.95	0.94	1.95	65.46	23
Sig. Level	**	***	***	*	***					
No. of lags	0	0	1	0	0					
Germany	-0.84	-0.68	-1.35	-9	-1.88	0.9	0.84	2.44	15.97	21
		***	**	***	***					
	0	0	0	2	0					
Italy	5.13	-0.51	-2.09	-0.01	-1.25	0.9	0.84	1.98	17.2	22
	***	**	***	**	***					
	0	0	1	0	0					
Japan	-2.23	0.14	-0.46	-0.02	0.46	0.89	0.84	1.98	15.69	21
	***			***	***					
	0	0	0	1	0					
S. Korea	2.41	-0.58	-4.11	0.002	-0.14	0.96	0.93	1.96	39.6	20
	***	**	***							
	0	2	3	1	0					

Table (4.3): Results of the estimates of the disaggregate export demand (equation 4.7)

$$\ln X_{it} = c_0 + c_1 \ln Y_{it} + c_2 \ln (PXSA/PM_i)_t + c_3 \ln EX_t + c_4 SDEX_t + c_5 DVEX + U_t \ldots (4.7)$$

Country	Y	PXSA/Pmi	EX	SDEX	DVEX	R-sq.	Adj-R-sq.	D.W.	F-test	n
Exp. Sign	+	-	-	-	-					
France	2	-0.49	-2.6	-1.23	-1.14	0.95	0.94	1.95	65.46	23
Sig. Level	**	***	***	*	***					
No. of lags	0	0	1	0	0					
Germany	-0.84	-0.68	-1.35	-9	-1.88	0.9	0.84	2.44	15.97	21
		***	**	***	***					
	0	0	0	2	0					
Italy	5.13	-0.51	-2.09	-0.01	-1.25	0.9	0.84	1.98	17.2	22
	***	**	***	**	***					
	0	0	1	0	0					
Japan	-2.23	0.14	-0.46	-0.02	0.46	0.89	0.84	1.98	15.69	21
	***			***	***					
	0	0	0	1	0					
S. Korea	2.41	-0.58	-4.11	0.002	-0.14	0.96	0.93	1.96	39.6	20
	***	**	***							
	0	2	3	1	0					

one case. Taking France as an example, it can be seen that as EX increases by one percent (an increase in EX indicates an appreciation of the US dollar vis-a-vis French franc) will lead to a reduction of Saudi exports to France by 2.6 percent. This can be explained by the fact that as long as Saudi exports; mainly oil, are priced in terms of the US dollar in the international market, then when the dollar appreciates against the French franc, Saudi exports to France become more expensive in terms of local currency, therefore discouraging Saudi exports to the French market.

The exchange-rate volatility term, SDEX has, in general, the expected negative sign and significantly differs from zero in six cases out of nine. This gives further support to the hypothesis that exchange rate volatility has an adverse impact on Saudi trade. The last variable, DVEX, which is the dummy variable that captures the change of Saudi exchange rate policy to the dollar-peg, has the expected negative sign in six out of nine cases, and is significantly different from zero in five of these six cases. This indicates that pegging the Saudi riyal to the US dollar may discourage exports, lending support to the view that pegging the Saudi riyal to the US dollar may not be the best possible policy of promoting Saudi exports. We turn now to the results of disaggregate import demand equations.

RESULTS OF THE ESTIMATES OF THE DISAGGRAGATE IMPORT DEMAND

Table (4.4) presents the regression results of the estimated equation (4.8), which was estimated for Saudi imports from Canada, France, Germany, Italy, Japan, South

Table (4.4): Results of the estimates of the disaggregate import demand (equation 4.8)

$$\ln M_{it} = d_0 + d_1 \ln Y_t + d_2 \ln (PX_i/PD)_t + d_3 \ln EX_t + d_4 SDEX_t + d_5 DVEX + d_6 TOT + U_t$$

Country	Y	Pxi/PD	EX	SDEX	DVEX	TOT	R-sq.	Adj-R-sq.	D.W.	F-test	n
Exp. Sign	+	-	-	-	-	+					
Canada	3.27	-1.86	-2.21	-34.48	0.43	0.31	0.99	0.98	2.17	93.55	20
Sig. Level	***	***	**	***	**	**					
No. of lags	0	1	0	1	0	0					
France	4.84	-1.32	-2.93	-24.24	-0.27	-0.15	0.99	0.98	2.31	116.25	19
	***	***	***	***	***						
	0	2	0	0	0	0					
Germany	3.85	-1.5	-0.73	-4.74	0.1		0.94	0.91	1.82	31.06	22
	***	***	**	**	***						
	0	1	0	1	0						
Italy	3.48	-1.91	-0.42	-1332.6	0.24	0.39	0.99	0.98	2.03	143.78	20
	***	***	**	***	*	***					
	0	1	0	1	0	0					
Japan	2.97	-1.01	-0.81	-584.7	0.43		0.94	0.91	1.79	30.74	22
	***	**	**	***	**						
	0	1	0	1	0						

Table (4.4): Results of the estimates of the disaggregate import demand (equation 4.8)

$$\ln M_{it} = d_0 + d_1 \ln Y_t + d_2 \ln (PX_i/PD)_t + d_3 \ln EX_t + d_4 SDEX_t + d_5 DVEX + d_6 TOT + U_t$$

Country	Y	Pxi/PD	EX	SDEX	DVEX	TOT	R-sq.	Adj-R-sq.	D.W.	F-test	n
Exp. Sign	+	-	-	-	-	+					
Canada	3.27	-1.86	-2.21	-34.48	0.43	0.31	0.99	0.98	2.17	93.55	20
Sig. Level	***	***	**	***	**	**					
No. of lags	0	1	0	1	0	0					
France	4.84	-1.32	-2.93	-24.24	-0.27	-0.15	0.99	0.98	2.31	116.25	19
	***	***	***	***	***						
	0	2	0	0	0	0					
Germany	3.85	-1.5	-0.73	-4.74	0.1		0.94	0.91	1.82	31.06	22
	***	***	**	**	***						
	0	1	0	1	0						
Italy	3.48	-1.91	-0.42	-1332.6	0.24	0.39	0.99	0.98	2.03	143.78	20
	***	***	**	***	*	***					
	0	1	0	1	0	0					
Japan	2.97	-1.01	-0.81	-584.7	0.43		0.94	0.91	1.79	30.74	22
	***	**	**	***	**						
	0	1	0	1	0						

Korea, Singapore, Spain, Switzerland, the UK and the US. These countries, taken together, provided Saudi Arabia in 1995 with more than 67 percent of its total imports. A close look at Table (4.4) reveals that the Saudi real GDP, Y, is the dominant determinant of its imports from its trading partners. For all reported cases, the estimated income elasticities with respect to imports are positive and significantly different from zero at the one percent level in all cases except one. This is not a surprising result for Saudi Arabia due to the fact that the Saudi economy is an open one, and it depends on importing most of its needs from abroad. Table (4.4) also reveals that the relative price term carries a significant negative coefficient in all but two cases. The price elasticities range from -1.01 in the case of Japan to -2.28 in the case of Switzerland. With few exceptions, these price elasticities are greater than one, in absolute terms, indicating that an increase in the relative price by one percent would lead to a reduction in Saudi imports from the corresponding trading partners by more than one percent. It is, therefore, safe to conclude that relative prices have a significant effect on Saudi bilateral trade flows.

Turning to the exchange rate term, EX, which is defined as units of Saudi riyal per unit of foreign currency i, we can see that in all, but in two cases, this variable carries the expected negative sign. It is also significantly different from zero in all but two cases. The magnitude of the effect, however, ranges from as low as -0.73, to as high as -2.93. The negative sign implies that as the Saudi riyal depreciates against currency i, Saudi imports from that country would fall, other things being equal. One exceptional case deserves mention here. The coefficient of EX for the case of US has a positive sign. This could be explained by the fact that as the Saudi riyal maintains a

stable relationship against the US dollar, this might encourage importing more from the US. This is in fact supported by the fact that Saudi Arabia imported, in 1995, about 22 percent of its total imports from the United States.

Regarding the exchange rate volatility term, SDEX, we can see that it is uniformly negative and statistically significant in all but two cases. Again, this is further evidence that exchange rate fluctuations have an adverse effect on Saudi trade flows. Estimates of the effect of the dummy variable, DVEX, have mixed results. It carries a negative sign in only three cases out of eleven. Terms of trade term, TOT, has the expected positive sign in six of the seven reported cases.

From these calculations we conclude that there seems to be enough evidence supporting the hypothesis that exchange rate volatility has its negative impact on Saudi trade flows.

SUMMARY

The purpose of this study was to empirically investigate the impact of exchange rate fluctuations on the trade flows of Saudi Arabia. This was accomplished by estimating both aggregate as well as disaggregate export and import demand functions for Saudi Arabia's trade flows. The models were estimated over the period 1973 through 1995. Because there was no consensus on which exchange rate measure to use, this study employed several exchange rate measures in assessing the impact of exchange rate variability on the trade flows of Saudi Arabia.

The results of the estimate of the aggregate Saudi export demand function show that, regardless of which exchange rate we used, almost all models indicate that exchange rate variability, however it is measured, has an adverse impact on Saudi aggregate exports. On the import side, the results of our estimation are in general conformity with our prior expectations, and can be summarized by saying that exchange rate fluctuations have adversely affected the aggregate Saudi imports.

Finally, the results of our estimates of the disaggregate exports and imports, in general, confirm our hypothesis that exchange rate variability has adversely affected Saudi bilateral exports as well as imports. These results also give further support to our hypothesis that exchange rate volatility has an adverse impact on Saudi trade flows.

CHAPTER FIVE

SUMMARY AND CONCLUDING OBSERVATIONS

Since the end of the Bretton Woods system, the impact of exchange rate variability on international trade flows has become an increasingly important issue. A principal concern is that exchange rate variability appears to increase risk and uncertainty in international transactions and may therefore adversely affect trade and investment flows. The adoption of the floating exchange rate regime by the industrialized countries, however, imposed a considerable increase in exchange rate fluctuations for the less developed countries (LDCs). Consequently, Saudi Arabia, like many other developing countries, was faced with the dilemma of what to peg its currency (the Saudi riyal) to. Its first choice was to peg it to the US dollar. However, the large fluctuations of the US dollar against other major currencies prompted a switch to the SDR in 1975. In the late 1980s, the riyal was again pegged to the US dollar and remains so to this day. With the riyal being fixed first to the SDR and later on to the US dollar, its exchange rate value was subject to major fluctuations against the currencies of the major industrial countries with which Saudi Arabia conducts most of its trade. These fluctuations and their impact on the trade flows of Saudi Arabia were the subject of this study.

The main purpose of this study was to empirically investigate the impact of exchange rate fluctuations of the Saudi riyal on the trade flows of Saudi Arabia over the

period of 1973 to 1995, using annual data and applying the ordinary least squares (OLS) technique. Traditional export and import demand equations were developed to study the relationship between the relative variables and their impact on trade flows. Both aggregate as well as bilateral models were used to test for the hypothesis that exchange rate fluctuations have an adverse effect on Saudi Arabia's trade flows. Besides the traditional variables used in these models, such as income and relative prices, this study employed various measures of exchange rate uncertainty as one of the important determinants of both aggregate and bilateral trade flows.

The major findings of this study on exchange rate volatility can be summarized as follows:

1. Exchange rates are shown to have an adverse effect on Saudi Arabia's trade flows. On the aggregate export level, exchange rates were found to exert a negative effect on the Saudi exports in eight out of ten cases. A negative sign implies that an appreciation of the effective exchange rate would lead to, other things being equal, a decrease in Saudi aggregate exports. The exchange rate risk measure, SDEX, also found to have a negative effect in eight out of ten cases. The impact on aggregate exports of the exchange rate policy switch to the dollar-peg, DVEX, was also found to be negative in all ten cases. The implication of these findings is that pegging the riyal to the US dollar may not be the optimal policy of promoting Saudi exports.
2. On aggregate imports side, our results of the estimated aggregate import demand for Saudi Arabia show that, regardless of which measure of exchange rate was used, the results of our estimates are in general conformity with our prior expectations that exchange rate fluctuations may adversely affect Saudi trade flows. SDEX had the

expected negative effect in all but one case. DVEX, also, had the negative impact in three out of five cases. Again, we can conclude that exchange rate variability has an adverse effect on the aggregate Saudi imports.

3. Bilateral trade flows are also found to be affected adversely by the exchange rate fluctuations. The exchange rate variable, EX, was found to have a negative effect in eight out of nine cases. An increase in EX indicates that an appreciation of the US dollar vis-à-vis foreign currencies would lead to a reduction of Saudi exports to those countries whose currencies depreciated against the US dollar. This can be explained by the fact that as long as Saudi exports; mainly oil, are priced in US dollars and the dollar exchange rate fluctuates against other currencies, the price of oil to oil-importing countries whose exchange rates are affected by changes in the dollar will also fluctuate. This in turn discourages Saudi exports to those countries. On the bilateral import side, as the US dollar weakens significantly against the currencies of other strong Saudi trade partners such as Japan and Germany, Saudi Arabia experiences a loss of purchasing power (i.e., a negative terms-of-trade effect) and therefore a reduced demand for imports from these countries. On the other hand, as the dollar strengthens relative to other currencies, Saudi Arabia might see its purchasing power slightly increase. Nevertheless, the net effect could well be negative should final oil demand from other countries such as Europe and Japan decline substantially.
4. The exchange rate volatility term, SDEX, had the expected negative effect on Saudi bilateral exports in most of the cases. It also carries the expected negative sign in ten

out of eleven cases of the bilateral imports. This gives further support to the hypothesis that exchange rate volatility has an adverse impact on Saudi trade flows.

5. The impact on bilateral exports of the switch to the dollar-peg, as represented by the variable DVEX, was also found to be negative in six out of nine cases. This indicates that pegging the Saudi riyal to the US dollar may discourage exports, lending support to the view that pegging the Saudi riyal to the US dollar may not be the optimal policy of promoting Saudi exports given the fact that the new thinking in the country is to promote exports and give the private sector a chance to play a major role in the economy. DVEX, on other hand, was negative in only three cases of the bilateral imports.

In addition to exchange rate volatility impacting trade flows, other key macro variables were also found significantly affecting Saudi exports and imports:

1. Real world income has a positive significant impact on Saudi exports. However, the magnitude of this effect, as measured by the income elasticities, varies across the models from being as low as 0.5 percent to about two percent. This implies that as the world income grows by one percent, there can be an increase in demand for Saudi exports by about two percent at most.
2. As illustrated by table 4.2, the Saudi real GDP also has a significant positive impact on Saudi imports. Across all the models, the income elasticity is greater than one and actually exceed three percent in some models, indicating that as the real Saudi GDP grows by one percent, the demand for imports will increase by more than three percent. This high income elasticity is not unexpected in the case of Saudi Arabia,

given the fact that it has an open economy which is characterized by its high degree of dependence on imports.

3. Relative prices have, in general, a significant impact on the trade flows of Saudi Arabia. The price elasticity in the aggregate export demand equation is less than one, indicating that an increase in the relative prices of Saudi exports by one percent will lead to a less than one percent reduction in Saudi exports. The magnitudes of the price elasticities in the aggregate import demand functions are, however, greater than those of the aggregate export demand. In general, these elasticities are greater than one, indicating that an increase in the relative prices of aggregate imports by one percent will lead to a decline in imports by more than one percent.
4. The " oil gap" variable also plays a significant role on the aggregate exports of Saudi Arabia. As the difference between the world oil demand and supply widens, the demand for Saudi exports will rise. Playing this role as a residual supplier in the world oil market has in the past proven too costly and Saudi Arabia should avoid playing the role of swing producer, especially in the context of OPEC, at any cost.
5. On the bilateral level, both foreign incomes and relative prices of Saudi Arabia's major trading partners have a significant effect on Saudi trade flows. The magnitude of these effects, however, varies among these countries.
6. Non-economic factors, mainly political in nature, have also played a significant impact on the level of Saudi aggregate exports.

Based on these observations, we can conclude that the hypothesis that exchange rate fluctuations have an adverse effect on the Saudi trade flows cannot be rejected. These results, however, should be interpreted with care since this study is not a general

equilibrium model type. These results do not take into consideration all changes in other sectors of the economy.

In light of the fact that we were unable to reject the hypothesis that exchange rate fluctuations have adversely affected the trade flows of Saudi Arabia, a question that may arise is what kind of exchange rate regime would be more appropriate for Saudi Arabia to adopt? The best choice obviously would be to adopt a flexible exchange rate regime. However, since the Saudi economy is by all means still a developing economy which specializes in exporting one major commodity (oil), imports almost everything else, and lacks well developed financial markets; operating under a floating exchange rate regime would make it highly susceptible to the transmission of shocks from abroad. Thus, the second best choice of exchange rate regime would be a switch to a trade-weighted currency basket. This choice should truly reflect the trade patterns of Saudi foreign trade.

This study was constrained by a lack of available data for some variables and trading partners. With the availability of more data, especially disaggregate data, this study could be extended to cover a wide range of trade flows between Saudi Arabia and its other trading partners. In addition, this study might also be carried out at a sectoral level to see whether exchange rate fluctuations affect various sectors of the economy differently. Finally, although, this study used five different exchange rate measures, it used only the standard deviations of these exchange rates as a measure of exchange rate risk. The use of other measures of exchange rate risk might prove to be insightful.

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APPENDICES

APPENDIX A:

STATISTICAL TABLES

Table A3.1: Saudi Crude Oil Production and Revenues.

Year	1960	1961	1962	1963	1964	1965	1966	1967	1968
Total Production	481.3	540.7	599.76	651.71	694.13	804.94	948.57	1023.84	1113.71
Percentage Change		12.3	10.9	8.7	6.5	16.0	17.8	7.9	8.8
Daily Production	1.32	1.48	1.64	1.79	1.9	2.21	2.6	2.81	3.04
Total Revenues	333.7	377.6	407.9	607.4	524.2	664.1	789.9	903.6	926.4
Percentage Change		13.2	8.0	48.9	-13.7	26.7	18.9	14.4	2.5

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977
Total Production	1173.89	1386.67	1740.68	2201.96	2772.61	3095.09	2582.53	3139.28	3357.96
Percentage Change	5.4	18.1	25.5	26.5	25.9	11.6	-16.6	21.6	7.0
Daily Production	3.22	3.8	4.77	6.02	7.6	8.48	7.08	8.58	9.2
Total Revenues	949.1	1214	1884.9	2744.6	4340.1	22573.5	25675.8	30754.8	36538.3
Percentage Change	2.5	27.9	55.3	45.6	58.1	420.1	13.7	19.8	18.8

Table A3.1: Saudi Crude Oil Production and Revenues.

Year	1960	1961	1962	1963	1964	1965	1966	1967	1968
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Daily Production	1.32	1.48	1.64	1.79	1.9	2.21	2.6	2.81	3.04
Total Revenues	333.7	377.6	407.9	607.4	524.2	664.1	789.9	903.6	926.4
Percentage Change		13.2	8.0	48.9	-13.7	26.7	18.9	14.4	2.5

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977
Total Production	1173.89	1386.67	1740.68	2201.96	2772.61	3095.09	2582.53	3139.28	3357.96
Percentage Change	5.4	18.1	25.5	26.5	25.9	11.6	-16.6	21.6	7.0
Daily Production	3.22	3.8	4.77	6.02	7.6	8.48	7.08	8.58	9.2
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Percentage Change	2.5	27.9	55.3	45.6	58.1	420.1	13.7	19.8	18.8

Table A3.2: Gross Domestic Product by Sectors (at current prices)
(Million Riyals)

Year	Total GDP	Percentage Change	Oil Sector	Percentage Change	Non-Oil Sector	Percentage Change
1969	17,152.00		9,566.00		7,586.00	
1970	22,582.00	31.66	14,329.00	49.79	8,253.00	8.79
1971	27,858.00	23.36	18,674.00	30.32	9,184.00	11.28
1972	40,086.00	43.89	28,684.00	53.60	11,402.00	24.15
1973	98,840.00	146.57	83,410.00	190.79	15,430.00	35.33
1974	139,225.00	40.86	111,101.00	33.20	28,124.00	82.27
1975	163,893.00	17.72	116,570.00	4.92	47,323.00	68.27
1976	203,943.00	24.44	136,249.00	16.88	67,694.00	43.05
1977	223,818.00	9.75	133,935.00	-1.70	89,883.00	32.78
1978	247,622.00	10.64	140,384.00	4.82	107,238.00	19.31
1979	383,589.00	54.91	252,705.00	80.01	130,884.00	22.05
1980	517,994.00	35.04	360,741.00	42.75	157,253.00	20.15
1981	522,176.00	0.81	337,884.00	-6.34	184,292.00	17.19
1982	411,797.00	-21.14	206,360.00	-38.93	205,437.00	11.47
1983	368,399.00	-10.54	157,989.00	-23.44	210,410.00	2.42
1984	347,424.00	-5.69	132,555.00	-16.10	214,869.00	2.12
1985	310,031.00	-10.76	96,958.00	-26.85	213,073.00	-0.84
1986	267,846.00	-13.61	67,461.00	-30.42	200,385.00	-5.95
1987	272,000.00	1.55	70,443.00	4.42	201,557.00	0.58
1988	276,908.00	1.80	69,115.00	-1.89	207,793.00	3.09
1989	304,083.00	9.81	90,749.00	31.30	213,334.00	2.67
1990	384,993.00	26.61	146,460.00	61.39	238,533.00	11.81
1991	435,037.00	13.00	167,525.00	14.38	267,512.00	12.15
1992	452,298.00	3.97	186,524.00	11.34	265,774.00	-0.65
1993	434,565.00	-3.92	158,364.00	-15.10	276,201.00	3.92
1994	441,736.00	1.65	157,722.00	-0.41	284,014.00	2.83
1995	461,621.00	4.50	167,049.00	5.91	294,572.00	3.72
1996	500,926.00	8.51	195,479.00	17.02	305,447.00	3.69

Source: SAMA, Annual Report, 1997, p.243

Table A3.3: Gross Domestic Product by Sectors (million riyals)
(constant prices of 1970)

Year	Total GDP	Percentage Change	Oil Sector	Percentage Change	Non-Oil Sector	Percentage Change
1969	17,152.00		9,566.00		7,586.00	
1970	19,582.00	14.17	11,542.00	20.66	8,040.00	5.98
1971	22,621.00	15.52	14,014.00	21.42	8,607.00	7.05
1972	27,133.00	19.95	17,413.00	24.25	9,720.00	12.93
1973	31,246.00	15.16	20,063.00	15.22	11,183.00	15.05
1974	31,539.00	0.94	18,903.00	-5.78	12,636.00	12.99
1975	34,250.00	8.60	19,112.00	1.11	15,138.00	19.80
1976	39,318.00	14.80	21,626.00	13.15	17,692.00	16.87
1977	41,765.00	6.22	21,513.00	-0.52	20,252.00	14.47
1978	44,521.00	6.60	21,999.00	2.26	22,522.00	11.21
1979	49,053.00	10.18	23,869.00	8.50	25,184.00	11.82
1980	52,971.00	7.99	24,653.00	3.28	28,318.00	12.44
1981	53,886.00	1.73	22,383.00	-9.21	31,503.00	11.25
1982	48,030.00	-10.87	14,309.00	-36.07	33,721.00	7.04
1983	47,995.00	-0.07	13,033.00	-8.92	34,962.00	3.68
1984	46,842.00	-2.40	11,453.00	-12.12	35,389.00	1.22
1985	44,936.00	-4.07	9,286.00	-18.92	35,650.00	0.74
1986	47,511.00	5.73	13,032.00	40.34	34,479.00	-3.28
1987	46,830.00	-1.43	11,524.00	-11.57	35,306.00	2.40
1988	49,923.00	6.60	13,931.00	20.89	35,992.00	1.94
1989	50,167.00	0.49	13,629.00	-2.17	36,538.00	1.52
1990	55,565.00	10.76	16,671.00	22.32	38,894.00	6.45
1991	60,284.00	8.49	20,618.00	23.68	39,666.00	1.98
1992	61,917.00	2.71	22,031.00	6.85	39,886.00	0.55
1993	61,511.00	-0.66	21,258.00	-3.51	40,253.00	0.92
1994	61,841.00	0.54	21,299.00	0.19	40,542.00	0.72
1995	62,003.00	0.26	21,356.00	0.27	40,647.00	0.26
1996	63,449.00	2.33	21,818.00	2.16	41,631.00	2.42

Note: Growth rates are calculated by the author.
Source: SAMA, Annual Report 1997, p.243.

Table A3.4: Shares of Oil and Non-Oil Sectors of Total GDP

	At Current Prices		At Constant 1970 Prices	
Year	Oil/GDP Ratio	Nonoil/GDP Ratio	Oil/GDP Ratio	NonOil/GDP Ratio
1969	0.56	0.44	0.56	0.44
1970	0.63	0.37	0.59	0.41
1971	0.67	0.33	0.62	0.38
1972	0.72	0.28	0.64	0.36
1973	0.84	0.16	0.64	0.36
1974	0.80	0.20	0.60	0.40
1975	0.71	0.29	0.56	0.44
1976	0.67	0.33	0.55	0.45
1977	0.60	0.40	0.52	0.48
1978	0.57	0.43	0.49	0.51
1979	0.66	0.34	0.49	0.51
1980	0.70	0.30	0.47	0.53
1981	0.65	0.35	0.42	0.58
1982	0.50	0.50	0.30	0.70
1983	0.43	0.57	0.27	0.73
1984	0.38	0.62	0.24	0.76
1985	0.31	0.69	0.21	0.79
1986	0.25	0.75	0.27	0.73
1987	0.26	0.74	0.25	0.75
1988	0.25	0.75	0.28	0.72
1989	0.30	0.70	0.27	0.73
1990	0.38	0.62	0.30	0.70
1991	0.39	0.61	0.34	0.66
1992	0.41	0.59	0.36	0.64
1993	0.36	0.64	0.35	0.65
1994	0.36	0.64	0.34	0.66
1995	0.36	0.64	0.34	0.66
1996	0.39	0.61	0.34	0.66

Source: Calculated by the author from Tables A3.2 and A3.3

Table A3.5: Saudi Exports and Imports and their Shares in Saudi Total GDP (million riyals at current prices).

Year	Exports (X)	Percentage Change	Imports (M)	Percentage Change	Total GDP	Percentage Change	X/GDP Ratio	M/GDP Ratio	(X+M)/GDP Ratio
1970	10,907.20	14.86	3,196.80	-5.35	22,582.00	31.66	0.48	0.14	0.62
1971	17,302.70	58.64	3,667.50	14.72	27,858.00	23.36	0.62	0.13	0.75
1972	22,761.20	31.55	4,708.30	28.38	40,086.00	43.89	0.57	0.12	0.69
1973	33,309.10	46.34	7,310.20	55.26	98,840.00	146.57	0.34	0.07	0.41
1974	126,222.90	278.94	10,149.20	38.84	139,225.00	40.86	0.91	0.07	0.98
1975	104,411.70	-17.28	14,823.00	46.05	163,893.00	17.72	0.64	0.09	0.73
1976	135,153.50	29.44	30,691.00	107.05	203,943.00	24.44	0.66	0.15	0.81
1977	153,208.60	13.36	51,662.00	68.33	223,818.00	9.75	0.68	0.23	0.92
1978	138,242.00	-9.77	69,179.70	33.91	247,622.00	10.64	0.56	0.28	0.84
1979	213,183.40	54.21	82,223.30	18.85	383,589.00	54.91	0.56	0.21	0.77
1980	362,885.00	70.22	100,349.60	22.05	517,994.00	35.04	0.70	0.19	0.89
1981	405,481.00	11.74	119,297.70	18.88	522,176.00	0.81	0.78	0.23	1.00
1982	271,090.10	-33.14	139,335.10	16.80	411,797.00	-21.14	0.66	0.34	1.00
1983	158,443.90	-41.55	135,417.20	-2.81	368,399.00	-10.54	0.43	0.37	0.80
1984	132,299.20	-16.50	118,736.60	-12.32	347,424.00	-5.69	0.38	0.34	0.72
1985	99,535.80	-24.76	85,563.60	-27.94	310,031.00	-10.76	0.32	0.28	0.60
1986	74,377.00	-25.28	70,779.60	-17.28	267,846.00	-13.61	0.28	0.26	0.54
1987	86,879.70	16.81	75,312.60	6.40	272,000.00	1.55	0.32	0.28	0.60
1988	91,287.70	5.07	81,581.70	8.32	276,908.00	1.80	0.33	0.29	0.62
1989	106,294.50	16.44	79,219.40	-2.90	304,083.00	9.81	0.35	0.26	0.61
1990	166,339.20	56.49	90,282.00	13.96	384,993.00	26.61	0.43	0.23	0.67
1991	178,624.30	7.39	108,934.00	20.66	435,037.00	13.00	0.41	0.25	0.66
1992	188,325.40	5.43	124,606.00	14.39	452,298.00	3.97	0.42	0.28	0.69
1993	158,770.00	-15.69	105,616.00	-15.24	434,565.00	-3.92	0.37	0.24	0.61
1994	159,590.00	0.52	87,449.00	-17.20	441,736.00	1.65	0.36	0.20	0.56

Source: Figures for GDP, Exports, Imports are from SAMA Annual Report 1997.The rest of the table is calculated by the author.

Table A3.6: Saudi Exports of Crude Oil and Refined Products
(Million Barrels)

Year	Crude C	Growth Rate	Refined R	rowt Rate	R/C Ratio	Average Growth Rate Crude	Refine	R/C
1962	501.30		81.59		0.16	10.81	10.13	0.15
1963	544.83	9	88.33	8	0.16			
1964	587.21	8	95.76	8	0.16			
1965	678.83	16	110.43	15	0.16			
1966	829.31	22	113.19	2	0.14			
1967	888.57	7	122.16	8	0.14			
1968	968.30	9	151.74	24	0.16			
1969	1,020.05	5	158.21	4	0.16			
1970	1,174.17	15	207.89	31	0.18	13	2	0.09
1971	1,528.19	30	193.95	-7	0.13			
1972	1,992.53	30	208.10	7	0.10			
1973	2,560.34	28	213.00	2	0.08			
1974	2,891.68	13	210.57	-1	0.07			
1975	2,409.39	-17	175.26	-17	0.07			
1976	2,939.64	22	205.78	17	0.07			
1977	3,142.05	7	188.39	-8	0.06			
1978	2,812.70	-10	174.80	-7	0.06			
1979	3,218.47	14	175.13	0	0.05			
1980	3,375.69	5	178.45	2	0.05	-6	11	0.19
1981	3,291.54	-2	193.75	9	0.06			
1982	2,058.40	-37	195.10	1	0.09			
1983	1,431.08	-30	146.67	-25	0.10			
1984	1,167.89	-18	177.85	21	0.15			
1985	780.72	-33	196.90	11	0.25			
1986	1,190.02	52	265.53	35	0.22			
1987	973.12	-18	248.11	-7	0.25			
1988	1,245.49	28	417.45	68	0.34			
1989	1,217.50	-2	398.92	-4	0.33			
1990	1,642.42	35	478.98	20	0.29	11	5	0.23
1991	2,382.11	45	450.23	-6	0.19			
1992	2,408.98	1	473.88	5	0.20			
1993	2,296.92	-5	516.05	9	0.22			
1994	2,275.27	-1	498.18	-3	0.22			
1995	2,296.13	1	482.38	-3	0.21			
1996	2,236.01	-3	546.07	13	0.24			

Source: SAMA Annual Report 1997, Tables 2a and 2b, pp.280-281

Table A3.7: Direction of Saudi Exports: Selected Countries
(Million Saudi Riyals)

Year	Total X	U.S.A.	Europe	Germany	UK	France	Italy	Spain	Other Asia	Japan	India	Singapore	S. Korea	Taiwan
1970	10907	98	4820	222	828	692	1179	466	3339	2323	130.9			
1971	17303	590	8286	578	1510	1662	1767	543	4414	2783	222.1			
1972	22761	1129	12580	736	1846	2111	2547	1220	5532	3444	231	375	399	280
1973	33309	1625	17466	1102	2651	3061	3322	1830	8219	4940	343	626	860	352
1974	126223	4417	65141	5541	11755	14570	13050	8139	31023	20135	1417	2161	3237	1238
1975	104412	4031	45418	3659	6271	11290	7894	5205	31135	26483	1223	2579	2219	903
1976	135154	6377	55498	4238	6618	15582	8587	5704	41074	27097	1404	4658	2559	1573
1977	153209	14575	60538	4435	6491	14704	11182	5579	47162	29080	991	5738	3804	1741
1978	138242	21771	51538	3779	4678	14776	9360	5468	46947	27881	882	6130	4572	2498
1979	213183	36753	85891	6022	7097	17856	17314	8264	64205	36983	1528	8394	6474	3287
1980	362886	55866	150905	11029	12844	33525	22305	10569	111200	63274	1086	14109	11784	5961
1981	405481	53439	168650	16987	13795	38640	28738	13272	127922	69542	2250	19362	12047	6435
1982	271090	21127	94824	11656	7741	24321	13412	7548	118810	64434	5397	14412	10626	6843
1983	158444	12696	38622	3738	2857	9236	8724	3911	84236	45059	4476	10781	5507	6068
1984	129794	8741	25933	2327	1914	5573	5949	2500	68540	42130	4191	7041	4067	6416
1985	99536	5465	23839	2122	1873	4984	3754	764	44635	29820	3075	2930	2000	4651
1986	74377	12393	23969	2208	2094	4133	5644	1932	23446	15137	1101	2026	1521	2830
1987	84600	16767	18692	1152	1337	2260	3507	2080	33068	19205	1753	4296	2700	3643
1988	91288	19860	21309	2117	2043	4530	2907	1443	30816	15416	2558	5311	1727	3955
1989	106241	27437	22661	927	1620	5549	4305	1827	35864	18545	2571	6352	2100	4069
1990	166339	39890	30571	984	2664	7917	5978	2181	60467	31559	4115	8917	6254	5634
1991	178624	40969	38045	1009	3525	8203	7675	3563	60246	28689	4103	9094	9938	4968
1992	188325	40168	41492	1992	3702	8239	7632	4149	67862	30791	5369	9868	12770	4795
1993	158770	27715	36525	1833	5167	6960	7971	2392	60157	26777	4971	7833	11931	4798
1994	159590	29518	36457	1980	3148	8471	8142	2141	59942	25470	4686	7735	12999	4320
1995	187403	31743	38209	957	2747	7347	7395	4359	78376	30346	5844	9972	18429	5470

Source: SAMA Annual Report, various issues.

Table A3.8: Saudi Exports to Selected Countries: Relative Shares (percentage of total exports).

Year	USA/TX	Europe/TX	Germ/TX	UK/TX	Fran/TX	Italy/TX	Spain/TX	O.Asia/TX	Japan/TX	India/TX	Sing/TX	S.Kor./TX	Taiwan/TX
1970	0.01	0.44	0.02	0.08	0.06	0.11	0.04	0.31	0.21	0.01	0.00	0.00	0
1971	0.03	0.48	0.03	0.09	0.10	0.10	0.03	0.26	0.16	0.01	0.00	0.00	0.00
1972	0.05	0.55	0.03	0.08	0.09	0.11	0.05	0.24	0.15	0.01	0.02	0.02	0.01
1973	0.05	0.52	0.03	0.08	0.09	0.10	0.05	0.25	0.15	0.01	0.02	0.03	0.01
1974	0.03	0.52	0.04	0.09	0.12	0.10	0.06	0.25	0.16	0.01	0.02	0.03	0.01
1975	0.04	0.43	0.04	0.06	0.11	0.08	0.05	0.30	0.25	0.01	0.02	0.02	0.01
1976	0.05	0.41	0.03	0.05	0.12	0.06	0.04	0.30	0.20	0.01	0.03	0.02	0.01
1977	0.10	0.40	0.03	0.04	0.10	0.07	0.04	0.31	0.19	0.01	0.04	0.02	0.01
1978	0.16	0.37	0.03	0.03	0.11	0.07	0.04	0.34	0.20	0.01	0.04	0.03	0.02
1979	0.17	0.40	0.03	0.03	0.08	0.08	0.04	0.30	0.17	0.01	0.04	0.03	0.02
1980	0.15	0.42	0.03	0.04	0.09	0.06	0.03	0.31	0.17	0.00	0.04	0.03	0.02
1981	0.13	0.42	0.04	0.03	0.10	0.07	0.03	0.32	0.17	0.01	0.05	0.03	0.02
1982	0.08	0.35	0.04	0.03	0.09	0.05	0.03	0.44	0.24	0.02	0.05	0.04	0.03
1983	0.08	0.24	0.02	0.02	0.06	0.06	0.02	0.53	0.28	0.03	0.07	0.03	0.04
1984	0.07	0.20	0.02	0.01	0.04	0.05	0.02	0.53	0.32	0.03	0.05	0.03	0.05
1985	0.05	0.24	0.02	0.02	0.05	0.04	0.01	0.45	0.30	0.03	0.03	0.02	0.05
1986	0.17	0.32	0.03	0.03	0.06	0.08	0.03	0.32	0.20	0.01	0.03	0.02	0.04
1987	0.20	0.22	0.01	0.02	0.03	0.04	0.02	0.39	0.23	0.02	0.05	0.03	0.04
1988	0.22	0.23	0.02	0.02	0.05	0.03	0.02	0.34	0.17	0.03	0.06	0.02	0.04
1989	0.26	0.21	0.01	0.02	0.05	0.04	0.02	0.34	0.17	0.02	0.06	0.02	0.04
1990	0.24	0.18	0.01	0.02	0.05	0.04	0.01	0.36	0.19	0.02	0.05	0.04	0.03
1991	0.23	0.21	0.01	0.02	0.05	0.04	0.02	0.34	0.16	0.02	0.05	0.06	0.03
1992	0.21	0.22	0.01	0.02	0.04	0.04	0.02	0.36	0.16	0.03	0.05	0.07	0.03
1993	0.17	0.23	0.01	0.03	0.04	0.05	0.02	0.38	0.17	0.03	0.05	0.08	0.03
1994	0.18	0.23	0.01	0.02	0.05	0.05	0.01	0.38	0.16	0.03	0.05	0.08	0.03
1995	0.17	0.20	0.01	0.01	0.04	0.04	0.02	0.42	0.16	0.03	0.05	0.10	0.03

Source: Calculated by the author from Table A3.7.

Table A3.9: Total Saudi Imports (million Saudi riyals) and its growth rates

Year	Total Imports	Growth Rate	Average Annual Growth Rate
1970	3,197.00		
1971	3,668.00	15	46
1972	4,708.30	28	
1973	7,197.00	53	
1974	10,149.00	41	
1975	14,823.00	46	
1976	30,691.00	107	
1977	51,662.00	68	
1978	69,180.00	34	
1979	82,223.00	19	
1980	100,350.00	22	1
1981	119,298.00	19	
1982	139,335.00	17	
1983	135,417.00	-3	
1984	118,737.00	-12	
1985	85,564.00	-28	
1986	70,780.00	-17	
1987	75,313.00	6	
1988	81,582.00	8	
1989	79,219.00	-3	
1990	90,282.00	14	5
1991	108,934.00	21	
1992	124,606.00	14	
1993	105,616.00	-15	
1994	87,449.00	-17	
1995	105,187.00	20	
1996	103,980.00	-1	

Notes: 1- Growth rate is calculated as a percentage change over the previous year.
2- Average annual growth rate is calculated over ten years.
3- Both rates are calculated by the author.

Source: SAMA Annual Report, 1997, p.249

Table A3.10: Composition of Saudi Imports, 1970-91 (Million Riyals).

TABLE (2)

COMPOSITION OF IMPORTS
YEARLY

(Million Riyals)

Commodity Group	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total Imports	3,197	3,668	4,708	7,197	10,149	14,923	30,691	51,662	69,180	82,223	100,350	119,298	139,335
1. Live animals and animal products	240	250	310	431	482	632	925	1,305	2,057	2,980	4,121	4,874	4,980
2. Vegetable products	501	500	496	661	911	938	1,428	1,647	2,730	3,986	5,515	7,144	8,276
3. Animal & vegetable fats oils & their products	42	74	61	58	72	100	147	224	296	386	554	407	517
4. Prepared foodstuffs, beverages spirits vinegar & tobacco	239	273	354	526	598	625	956	2,029	2,710	3,370	4,172	4,954	4,961
Of which:													
Sugar	33	56	80	113	151	119	148	202	217	238	729	1,247	626
Flour	63	76	82	77	153	256	366	315	430	590	203	286	162
5. Mineral products	93	113	97	113	325	324	919	1,927	2,692	2,249	3,155	3,063	3,013
Of which: Cement	48	59	35	45	194	169	589	1,331	1,511	1,436	2,139	1,906	1,920
6. Products of the chemical & allied industries	180	240	244	399	442	668	980	1,739	2,253	2,667	3,475	4,121	4,981
7. Artificial resins and plastic materials, cellulose esters rubber synthetic rubber	83	97	114	162	242	376	624	1,171	1,496	2,094	2,795	2,911	3,397
8. Raw hides and skins, fur skins and articles thereof, travel goods and hand bags	5	9	15	25	32	50	101	201	272	307	395	409	471
9. Wood & articles of wood charcoal,cork & articles of cork and wicker work	63	81	78	146	224	372	1,535	2,139	2,058	2,332	2,597	2,650	2,711
Of which: Wood	62	78	75	139	209	349	505	1,998	1,945	2,280	2,232	2,466	2,615
10. Paper making materials, paper card board & articles thereof	47	62	66	113	177	604	254	566	771	910	1,107	1,353	1,536
11.Textiles and textile articles	142	203	344	696	955	1,291	2,170	3,496	4,178	4,996	6,571	7,294	8,251
12. Footwear, headgear, umbrellas, sunshade whips, artificial flowers, articles, of human hair & Fans	15	22	40	51	108	77	120	242	270	395	590	674	798
13. Articles of stone plaster, asbestos ceramic products, glass & glassware	42	46	54	76	196	199	513	1,460	1,247	2,690	3,421	3,515	3,487
14. Pearls, precious & semi-precious stones, precious metals,articles and imitation jewelry	90	63	67	79	89	429	1,374	1,986	1,659	1,901	2,397	3,479	3,927
15. Base metal & articles of base metals	300	393	477	772	1,071	1,393	3,586	7,650	9,588	12,290	14,611	17,483	20,716
16. Machinery,mechanical appliances, electrical equipment & parts thereof	590	690	973	1,512	1,995	2,993	7,454	13,961	19,911	22,552	28,538	30,829	35,536
17. Transport equipment	425	420	712	1,023	1,691	3,063	5,632	6,607	9,036	10,992	13,928	17,282	24,034
Of which:													
- Cars (including buses, trucks, pick-ups, etc.)	264	244	366	432	1,294	2,070	3,909	5,100	5,562	6,940	9,535	9,670	13,812
18. Optical, photographic, measuring checking precision medical & surgical instruments & apparatus, clocks & watches, musical instruments, sound records & reproducers & parts thereof	66	97	139	230	336	516	1,139	1,714	2,654	2,903	3,616	4,113	4,666
19. Arms, ammunition and parts thereof	4	5	2	2	20	17	171	182	91	19	61	29	9
20. Miscellaneous manufactured articles	97	90	66	112	202	275	571	1,216	1,919	2,300	2,772	2,979	3,553
21. Work of art collection pieces and antiques					1	5	92	221	13	219	207	222	270

Source : Ministry of Finance and National Economy, Central Dept. of Statistics Foreign Trade Statistics Yearbooks

Table A3.10: Composition of Saudi Imports, 1970-91 (Million Riyals).

COMPOSITION OF IMPORTS
YEARLY

(Million Riyals)

Commodity Group	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Imports	145,417	118,735	85,562	70,780	75,313	81,582	79,221	90,139	108,881
1 Live animals and animal products	4,975	4,606	3,911	4,035	4,326	4,278	4,392	4,838	5,613
2 Vegetable products	6,588	8,859	5,036	4,357	4,720	4,789	4,099	3,747	4,610
3 Animal & vegetable fats oils & their products	426	550	390	318	347	267	212	303	490
4 Prepared foodstuffs, beverages spirits vinegar & tobacco	4,597	4,634	3,558	3,203	3,507	3,768	3,461	3,649	4,446
5 Mineral products	3,475	2,912	1,419	907	859	711	727	760	844
6 Products of the chemical & allied industries	5,084	5,245	4,801	4,916	5,838	6,470	5,274	7,232	8,065
7 Artificial resins and plastic materials, cellulose esters rubber synthetic rubber	3,501	3,468	2,915	2,810	3,057	3,302	2,944	3,518	4,213
8 Raw hides and skins, fur skins and articles thereof, travel goods and hand bags	504	485	391	377	409	393	374	358	435
9 Wood & articles of wood charcoal cork & articles of cork and wicker work	2,799	2,094	1,142	868	927	1,403	1,088	1,249	1,564
10 Paper making materials, paper card board & articles thereof	1,600	1,686	1,204	1,148	1,379	1,680	1,349	1,746	1,879
11 Textiles and textile articles	9,056	8,823	7,524	7,303	8,566	8,665	7,354	7,947	9,169
12 Footwear, headgear, umbrellas, sunshade whips, artificial flowers, article, of human hair & Fans	920	852	785	740	933	982	975	895	1,194
13 Articles of stone plaster, asbestos cermaic products, glass & glassware	4,160	3,669	2,637	1,959	1,921	1,965	1,666	1,677	1,846
14 Pearls, precious & semi-precious stoners, precious metals,articles and imitation jewelery	4,205	3,605	3,293	1,944	2,135	1,970	3,848	6,214	5,541
15 Base metal & articles of base metals	19,101	14,183	10,277	6,524	6,308	8,133	6,476	7,850	9,983
16 Machinery,mechanical appliances, electrical equipment & parts thereof	36,120	28,409	17,841	14,683	14,415	15,527	14,557	14,777	21,115
17 Transport equipment	19,087	15,916	12,305	9,427	10,190	11,930	14,640	18,471	22,868
18 Optical, photographic, measuring checking precision medical & surgical instruments & apparatus, clocks & watches, musical instruments, sound records & reproducers & parts thereof	5,279	5,014	3,472	2,949	3,067	3,110	2,927	2,836	3,072
19. Arms, ammunition and parts thereof	13	24	17	28	26	24	21	28	45
20. Miscellaneous manufactured articles	3,613	3,355	2,449	1,983	2,099	2,034	1,773	1,751	2,648
21. Work of art collection pieces and antiques	317	337	395	298	304	311	265	244	303

Source : Ministry of Finance and National Economy, Central Dept. of Statistics, Foreign Trade Statistics Yearbooks

Table A3.11: Saudi Imports from Selected Countries

(Million Saudi Riyals)

Year	Total Imports	USA	Canada	Europe	France	Germany	Italy	UK	Japan	S. Korea	Switzerland	Taiwan	Spain	Asia
1970	3,197.00	569.00	n/a	1,150.00	88.00	313.00	143.00	231.00	314.00	n/a	44.00	n/a	n/a	611.00
1971	3,668.00	615.00	14.10	1,295.00	79.00	289.00	161.00	328.00	414.00	n/a	52.00	n/a	n/a	715.00
1972	4,708.30	916.70	8.20	1,438.10	107.50	293.90	190.60	345.00	675.70	7.70	48.70	62.60	13.10	1,025.40
1973	7,197.00	1,407.00	n/a	2,097.40	156.30	457.50	197.50	466.10	1,132.60	22.60	100.00	99.00	13.00	1,641.30
1974	10,149.00	1,735.00	16.00	2,695.00	180.00	612.00	280.00	492.00	1,616.00	33.00	118.00	109.00	8.00	2,365.00
1975	14,823.00	2,538.00	35.00	4,669.00	332.00	1,017.00	578.00	1,147.00	2,267.00	81.00	419.00	188.00	37.00	3,152.00
1976	30,691.00	5,739.00	36.00	10,844.00	821.00	2,538.00	1,504.00	1,815.00	3,731.00	218.00	1,094.00	320.00	85.00	5,673.00
1977	51,662.00	9,621.00	130.00	19,424.00	1,728.00	4,320.00	3,168.00	3,182.00	5,981.00	665.00	1,510.00	783.00	260.00	10,468.00
1978	69,180.00	14,434.00	239.00	31,323.00	2,668.00	7,467.00	4,945.00	5,093.00	10,659.00	1,105.00	1,952.00	1,577.00	641.00	17,612.00
1979	82,223.00	16,270.00	429.00	36,838.00	3,754.00	9,024.00	6,047.00	5,841.00	13,021.00	1,598.00	1,511.00	1,990.00	1,123.00	21,671.00
1980	100,350.00	20,086.00	456.00	43,216.00	5,440.00	9,112.00	7,346.00	6,504.00	17,992.00	2,408.00	1,741.00	2,238.00	1,808.00	28,622.00
1981	119,298.00	25,567.00	556.00	49,608.00	6,843.00	11,395.00	8,010.00	7,407.00	21,825.00	3,451.00	2,301.00	2,677.00	1,796.00	34,180.00
1982	139,335.00	29,193.00	930.00	59,018.00	7,451.00	15,310.00	8,463.00	9,166.00	26,658.00	3,745.00	2,751.00	2,911.00	2,007.00	39,841.00
1983	135,417.00	26,735.00	1,167.00	58,448.00	7,232.00	13,471.00	10,225.00	8,376.00	26,367.00	3,884.00	3,169.00	3,245.00	2,512.00	39,955.00
1984	118,737.00	20,655.00	776.00	49,117.00	9,252.00	9,861.00	8,595.00	6,898.00	23,568.00	3,579.00	2,379.00	3,236.00	2,280.00	35,642.00
1985	85,564.00	14,529.00	355.00	34,261.00	4,359.00	7,192.00	6,690.00	5,280.00	16,221.00	3,165.00	1,926.00	2,515.00	1,586.00	26,206.00
1986	70,780.00	12,352.00	433.00	28,543.00	3,990.00	5,747.00	5,182.00	5,151.00	11,131.00	2,905.00	1,399.00	2,520.00	1,216.00	20,615.00
1987	75,313.00	11,492.00	623.00	29,735.00	3,966.00	5,827.00	5,145.00	5,847.00	12,996.00	3,668.00	1,866.00	2,917.00	1,138.00	24,432.00
1988	81,582.00	13,255.00	527.00	31,308.00	4,259.00	5,897.00	5,266.00	5,947.00	13,045.00	3,850.00	1,886.00	2,716.00	1,207.00	24,973.00
1989	79,219.00	14,392.00	823.00	31,539.00	3,410.00	4,959.00	4,531.00	8,064.00	11,288.00	3,154.00	3,964.00	2,270.00	1,017.00	21,870.00
1990	90,282.00	15,066.00	730.00	38,569.00	3,573.00	6,645.00	4,181.00	10,182.00	13,815.00	2,960.00	5,929.00	1,969.00	984.00	24,154.00
1991	108,934.00	22,025.00	1,014.00	45,573.00	4,367.00	8,521.00	5,028.00	12,268.00	14,915.00	3,220.00	5,282.00	2,128.00	1,385.00	26,575.00
1992	124,606.00	28,075.00	1,069.00	50,787.00	6,002.00	9,262.00	6,181.00	13,418.00	17,591.00	3,330.00	5,695.00	2,096.00	1,448.00	30,203.00
1993	105,616.00	21,727.00	1,192.00	41,701.00	4,349.00	7,406.00	5,345.00	11,655.00	13,326.00	2,819.00	3,907.00	1,834.00	1,229.00	24,975.00
1994	87,449.00	18,657.00	1,471.00	34,121.00	3,806.00	7,246.00	4,116.00	7,400.00	10,270.00	2,477.00	3,634.00	1,402.00	1,323.00	19,535.00
1995	105,187.00	22,633.00	1,178.00	42,337.00	5,019.00	8,273.00	4,620.00	8,904.00	9,312.00	3,304.00	5,198.00	1,515.00	1,551.00	21,437.00
1996	103,980.00	22,771.00	1,486.00	n/a	4,313.00	7,798.00	4,901.00	9,334.00	7,314.00	2,940.00	4,856.00	1,547.00	1,414.00	19,526.00

Note: Data for 1970 and 1971 are taken from El-Mallakh, 1982, Table10.7, p.352

Source: SAMA Annual Reports 1991 and 1997

Table A3.12: Monthly Average Exchange Rate (Saudi riyals per SDR).

Month	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
January	4.500000	4.500000	4.505696	4.505696	4.282542	4.376492	4.136590	4.084832	4.391079	4.294697
February	4.500000	4.500000	4.505696	4.499685	4.282542	4.419696	4.128916	4.078398	4.422048	4.320885
March	4.500000	4.500000	4.505696	4.499685	4.282542	4.398514	4.086621	4.086203	4.247629	4.317660
April	4.500000	4.500000	4.505696	4.499685	4.282542	4.314465	4.065012	4.096461	4.247910	4.307750
May	4.500000	4.500000	4.505696	4.499685	4.282542	4.350606	4.053119	4.101219	4.192153	4.298552
June	4.500000	4.500000	4.505696	4.499685	4.282542	4.350312	4.037602	4.102554	4.236586	4.329562
July	4.500000	4.500000	4.505696	4.499685	4.270508	4.249252	4.042369	4.139339	4.283902	4.377430
August	4.500000	4.500000	4.505696	4.282542	4.226486	4.193028	4.054152	4.112323	4.261997	4.361944
Septembe	4.500000	4.500000	4.505696	4.282542	4.207870	4.157381	4.072427	4.090343	4.234992	4.376665
October	4.500000	4.500000	4.505696	4.282542	4.232872	4.160902	4.076390	4.129330	4.317100	4.359682
November	4.500000	4.500000	4.505696	4.282542	4.265081	4.162971	4.073822	4.154712	4.257186	4.356240
December	4.500000	4.505696	4.505696	4.282542	4.308623	4.134399	4.080281	4.209484	4.295496	4.415389

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
January	4.431570	4.215985	3.938544	3.778785	3.619663	3.487696	4.002438	4.685946	5.157969	4.963267
February	4.405348	4.107820	3.868836	3.745585	3.668891	3.438290	4.115702	4.726824	5.076599	4.929412
March	4.262130	4.108317	3.836720	3.729022	3.733139	3.468840	4.185775	4.753754	5.136023	4.886772
April	4.214250	4.052129	3.819091	3.728191	3.715953	3.570343	4.192939	4.836912	5.173976	4.867590
May	4.337566	3.969738	3.886441	3.729647	3.659146	3.567416	4.259748	4.885150	5.152955	4.740268
June	4.390686	3.926945	3.773640	3.682375	3.645639	3.624218	4.361601	4.818234	5.043260	4.646312
July	4.403677	3.867112	3.774878	3.661773	3.575431	3.717667	4.454176	4.753646	4.887813	4.762175
August	4.353185	3.830258	3.732423	3.638553	3.562238	3.766204	4.525148	4.753760	4.838791	4.725243
Septembe	4.370385	3.904951	3.709129	3.651669	3.536676	3.748654	4.534218	4.836220	4.844879	4.671585
October	4.336951	3.940552	3.679983	3.691418	3.529360	3.882538	4.538115	4.851173	4.941860	4.764536
November	4.253116	3.981784	3.665449	3.654963	3.564303	3.936768	4.488052	5.053565	5.080607	4.783316
December	4.207974	3.974730	3.758192	3.622868	3.513501	3.972030	4.522025	5.180109	5.077919	4.875845

	1990	1991	1992	1993	1994	1995	1996	1997
January	4.937819	5.328980	5.277932	5.157120	5.143520	5.489514	5.497005	5.300918
February	4.968100	5.395168	5.207337	5.137048	5.196259	5.535709	5.491162	5.185348
March	4.874906	5.171689	5.115669	5.169856	5.250433	5.752721	5.474503	5.161041
April	4.873582	5.067138	5.130964	5.290513	5.258959	5.902963	5.433490	5.136333
May	4.935368	5.031475	5.198528	5.301530	5.299225	5.835898	5.410216	5.187684
June	4.920753	4.941019	5.287075	5.279569	5.344497	5.856046	5.403691	5.206786
July	5.033447	4.949370	5.407702	5.206482	5.456791	5.833387	5.427833	5.158047
August	5.157770	5.002325	5.454637	5.248703	5.446775	5.658305	5.461343	5.070613
Septembe	5.207457	5.065419	5.474832	5.308543	5.481864	5.557662	5.423776	5.090693
October	5.349828	5.100777	5.373742	5.271100	5.532320	5.611088	5.391629	5.130276
November	5.410807	5.186422	5.194358	5.201923	5.509812	5.597827	5.441380	5.146747
December	5.342597	5.265419	5.201254	5.182883	5.437777	5.562514	5.385965	5.071470

Source: SAMA, Monthly Statistical Bulletin, various issues.

Table A3.13: Exchange Rate: Saudi Riyals per US Dollar and SDR

Year	SRs/$	SRs/SDR
1961	4.500	4.500000
1962	4.500	4.500000
1963	4.500	4.500000
1964	4.500	4.500000
1965	4.500	4.500000
1966	4.500	4.500000
1967	4.500	4.500000
1968	4.500	4.500000
1969	4.500	4.500000
1970	4.500	4.500000
1971	4.470	4.500000
1972	4.150	4.510000
1973	3.690	4.500000
1974	3.550	4.248186
1975	3.518	4.272335
1976	3.530	4.045608
1977	3.525	4.115433
1978	3.400	4.282340
1979	3.361	4.343038
1980	3.327	4.330570
1981	3.383	3.990027
1982	3.427	3.786944
1983	3.455	3.692904
1984	3.524	3.610293
1985	3.623	3.681722
1986	3.704	4.348328
1987	3.745	4.844608
1988	3.745	5.034388
1989	3.745	4.801360
1990	3.745	5.084370
1991	3.745	5.125433
1992	3.745	5.277002
1993	3.745	5.229606
1994	3.745	5.363186
1995	3.745	5.682803
1996	3.745	5.436833
1997	3.745	5.153830

Sources: 1- SAMA, Annual Report 1997, p.260; and 4th Qrts of 1985, 1990, and 1997
2- SAMA, Statistical Summary, 1979

Table A3.14: Saudi Riyal Exchange Rates: Riyals per currency unit

Year	German DM	French Francs	Italian Lira	Japanese Yen	UK Pound	US Dollar	Canadian Dollar	Spanish Pesetas	Swiss Franc	IMF SDR
1974	1.47330	1.25203		84.77450	8.33720	3.55000				4.34640
1975	1.34610	1.27065		86.43042	7.14300	3.53000				4.13240
1976	1.49420	1.40786		82.91874	6.00950	3.53000				4.10130
1977	1.66510	1.34246		68.49315	6.68050	3.50500				4.25760
1978	1.81350	1.26088	250.00000	58.82353	6.74440	3.31500	2.79510	21.14165	2.04950	4.31870
1979	1.94350	1.19460	238.66348	71.42857	7.48380	3.36500	2.88070	19.68504	2.10840	4.43280
1980	1.69730	1.35814	278.55153	60.97561	7.93010	3.32500	2.78310	23.80952	1.88550	4.24070
1981	1.51450	1.68322	353.35689	64.51613	6.51580	3.41500	2.87970	28.57143	1.89880	3.99003
1982	1.44540	1.95771	398.40637	68.49315	5.54580	3.43500	2.78070	36.63004	1.72220	3.78447
1983	1.27580	2.40211	478.46890	66.66667	5.04080	3.47500	2.79250	45.04505	1.59440	3.69310
1984	1.13560	2.68312	540.54054	70.42254	4.13450	3.57500	2.70730	48.54369	1.38300	3.61190
1985	1.48090	2.07426	469.48357	55.24862	5.26520	3.64500	2.60540	42.37288	1.75540	3.67770
1986	1.92960	1.72354	362.31884	42.73504	5.52200	3.74500	2.71280	35.33569	2.30670	4.34460
1987	2.36800	1.42592	312.50000	32.89474	7.00870	3.74500	2.87410	29.06977	2.93040	4.84250
1988	2.10360	1.61786	348.43206	33.55705	6.77660	3.74500	3.13990	30.30303	2.49000	5.03300
1989	2.20580	1.54560	338.98305	38.31418	6.01260	3.74500	3.23460	29.32551	2.42160	4.80140
1990	2.50670	1.36949	302.11480	35.84229	7.22040	3.74500	3.22570	25.90674	2.89080	5.08440
1991	2.47030	1.38313	312.50000	33.44482	7.00570	3.74500	3.24070	25.83979	2.76890	5.12590
1992	2.32030	1.47037	393.70079	33.33333	5.66240	3.74500	2.95280	30.67485	2.57210	5.27700
1993	2.16940	1.57431	454.54545	29.85075	5.54710	3.74500	2.82860	37.87879	2.53470	5.22960
1994	2.41800	1.42755	434.78261	26.66667	5.85160	3.74500	2.66970	35.21127	2.85550	5.36320
1995	2.61250	1.30839	416.66667	27.47253	5.80470	3.74500	2.74320	32.46753	3.25510	5.68280

Note: Exchange rates for French franc, Italian lira, Japanese yen, and Spanish peseta are expressed as units of foreign currencies per Saudi riyal.

Source: SAMA 4th Qtr 1994 and 1st Qtr 1998

APPENDIX B:

FIGURES

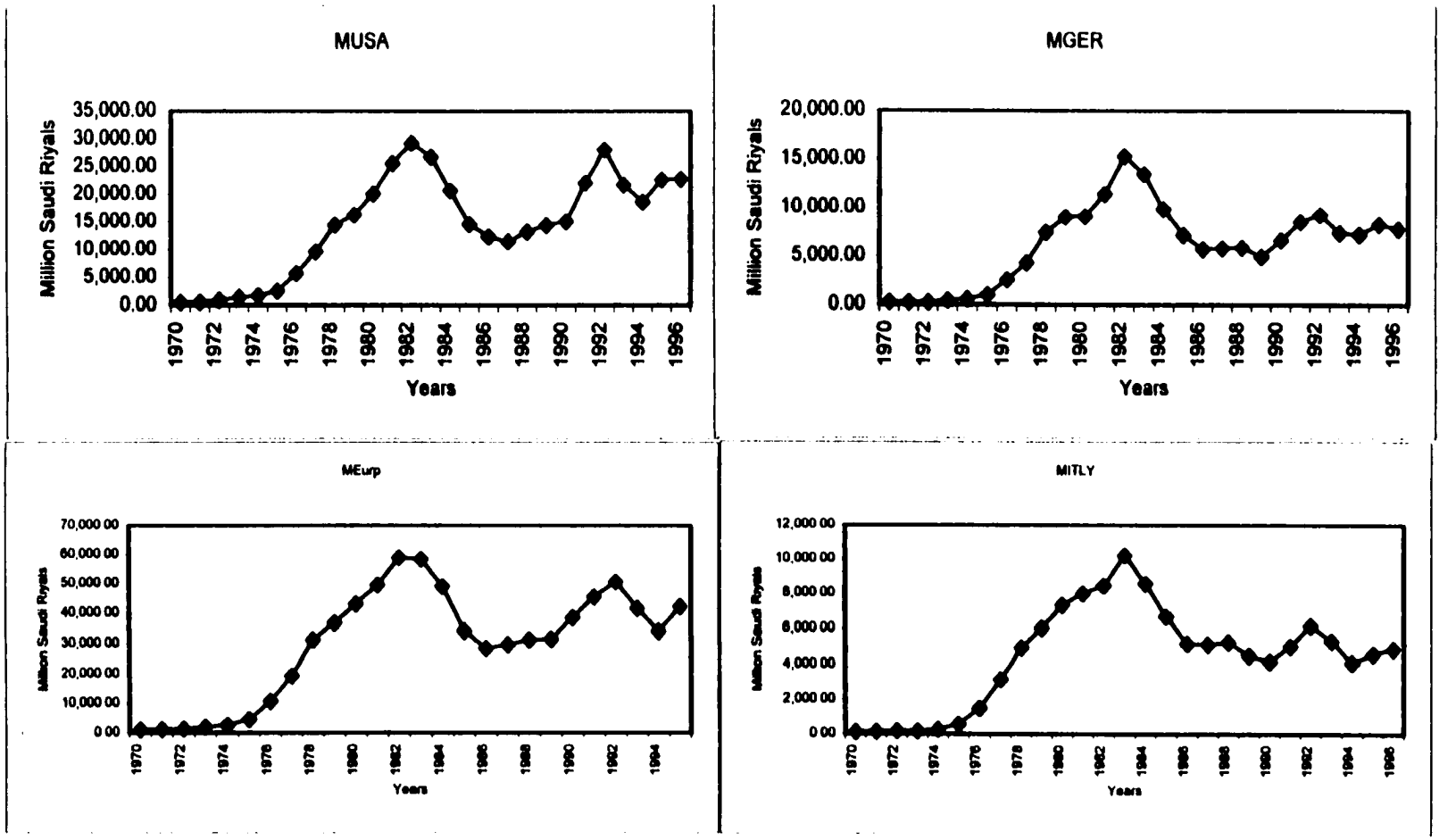

Figure A3.1: Saudi Imports from Selected Countries.

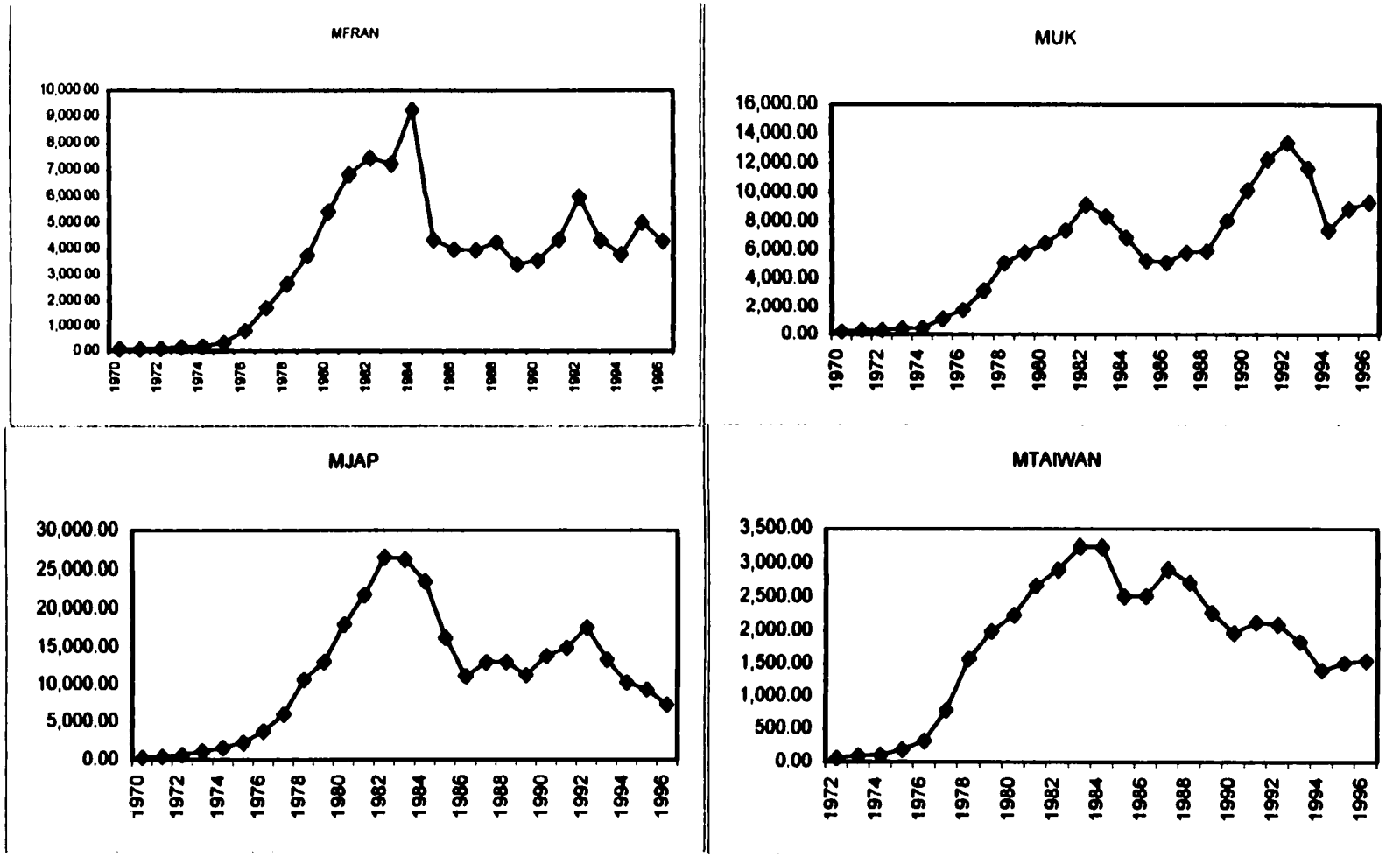

Figure A3.1: Saudi Imports from Selected Countries (continued).

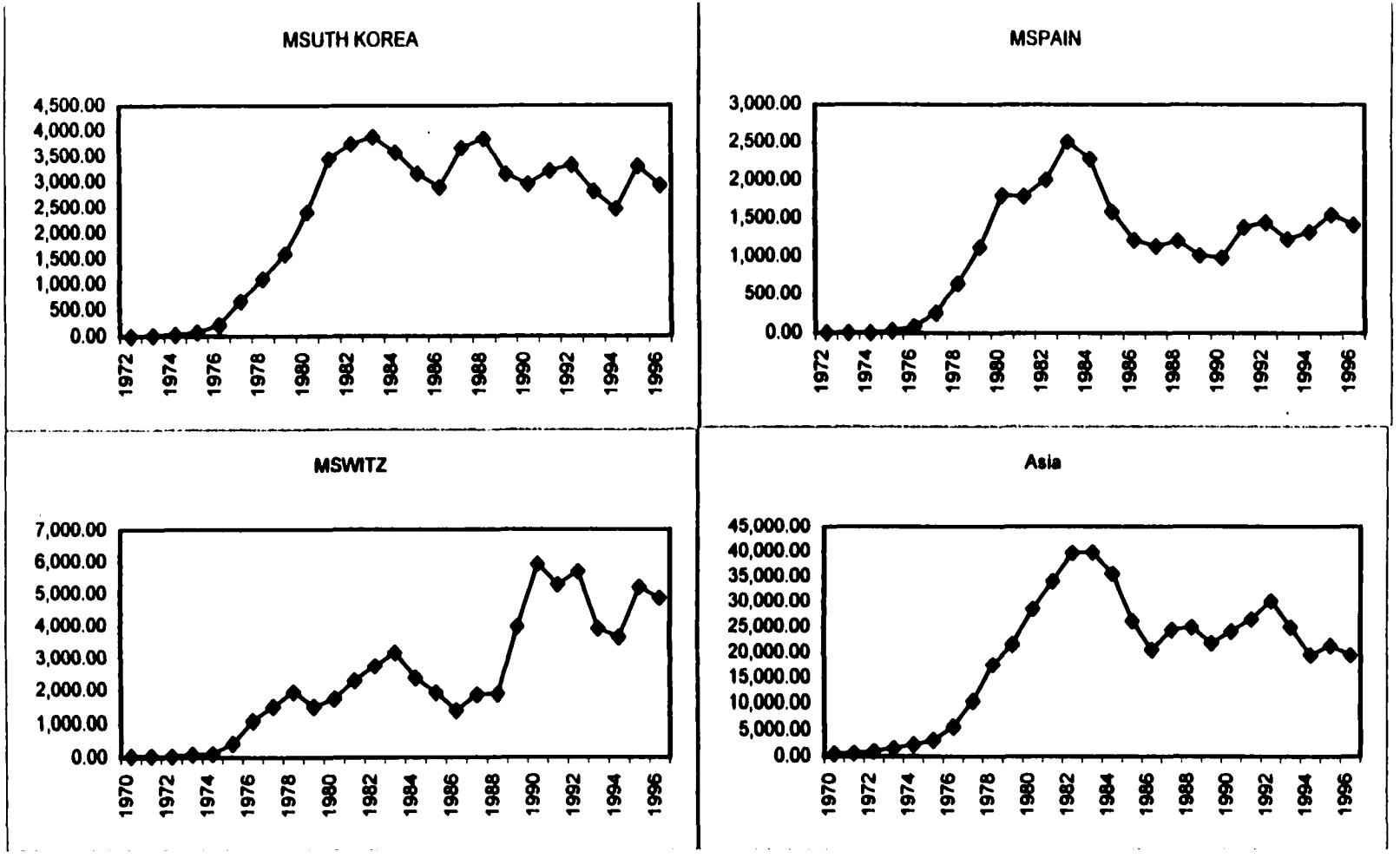

Figure A3.1: Saudi Imports from Selected Countries (continued).

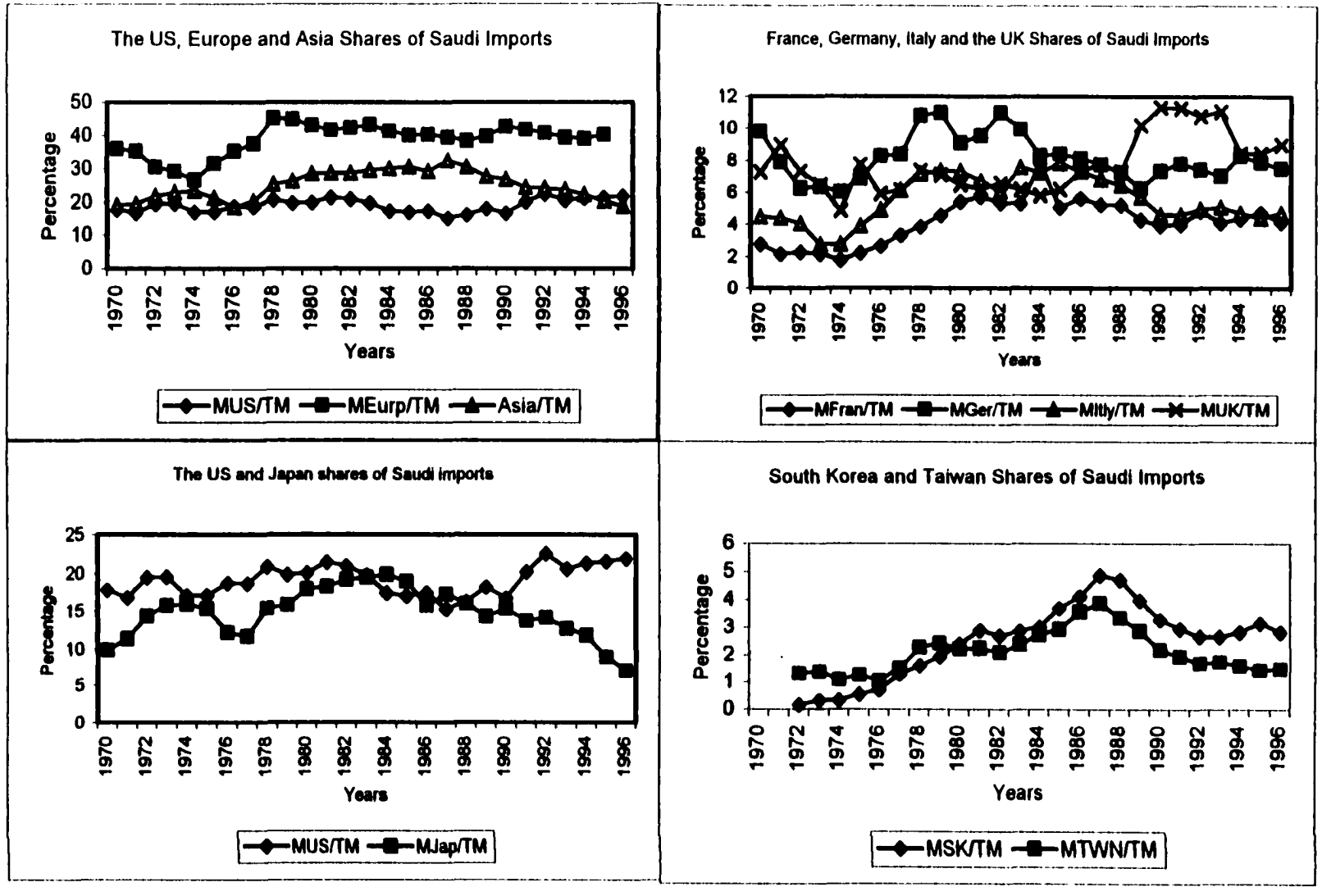

Figure A3.2: Saudi Imports from Selected Countries (relative share to total imports).

APPENDIX C:

DATA: SOURCES AND DEFINITIONS

Data: Sources and Definitions

Data Sources

The Data used in this study are collected from the following sources:

1- International Energy Agency (1998) World Energy Outlook.

2- International Monetary Fund (IMF), International Financial Statistics Yearbook 1998.

3- Saudi Arabian Monetary Agency (SAMA), Annual Report, various issues.

4- Saudi Arabian Monetary Agency (SAMA), Quarterly Statistical Bulletin, various issues.

5- The Board of Governors of the Federal Reserve System: Federal Reserve Bulletin, various issues.

6- World Bank, World Tables, issues 1991 and 1995.

Data Definitions:

YW = Index of world GDP, 1990 = 100

Y = Saudi GDP at 1990 prices. (billions of Saudi riyals)

RTX = Real Total Exports in million Saudi riyals

OILGAP = Oil Gap, defined as the difference between the total world oil demand and supply of oil from non-OPEC countries

PXSA = Exports Unit Values for Saudi Arabia, 1990 = 100

PMi = Price of imports in country i

PX = Export prices for Saudi Arabia (fob), 1987 = 100

PXW = Export Unit Values for Industrial Countries, 1990 = 100

PM = Import prices for Saudi Arabia (cif), 1987 = 100

PD = Saudi CPI, 1990 = 100

Xi = Real Saudi Exports to Country i

Yi = Real GDP in country i

Mi = Real Saudi imports from Country i

PXi = Price of exports in country i

TOT = Saudi terms of trade, defined as the prices of exports divided by the prices of imports

TWA = Trade-weighted index of the foreign exchange value of the U.S. dollar against the G-10 Countries

BNEER = Bahmani-Oskooee's Nominal Effective Exchange Rate for Saudi Arabia

BREER = Bahmani-Oskooee's Real Effective Exchange Rate for Saudi Arabia

NEER = Nominal Effective Exchange Rate for Saudi riyal, defined as a number of foreign currency units per Saudi riyal, calculated by the author.

REER = Real Effective Exchange Rate for Saudi riyal, defined as above and calculated by the author.

SDEX = Standard Deviations of the corresponding exchange rate

DVEX = A dummy variable to account for the switch of the riyal exchange rate to the dollar-peg. DVEX equals one for the years 1987- 1998 and zero otherwise.

DV1 = A dummy variable to account for non-economic factors that have impacted the oil market positively. It is equal to one for the years 1978, 1979, 1987, 1995 and zero otherwise.