THE OPTIMAL CURRENCY-PEG FOR AN OIL-EXPORTING COUNTRY: THE CASE OF SAUDI ARABIA

By

MOSAED S. ALMASBAHI

Bachelor of Science
University of Riyadh
Riyadh, Saudi Arabia
1979

Master of Science in Economics
Iowa State University
Ames, Iowa
1984

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May, 1990

THE OPTIMAL CURRENCY-PEG FOR AN OIL-EXPORTING COUNTRY: THE CASE OF SAUDI ARABIA

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

ACKNOWLEDGMENTS

I wish to express my deepest appreciation to my dissertation advisor Dr. Andreas Savvides for his encouragement and advice throughout my graduate program. I also extend my thanks to my dissertation committee members, Dr. Michael Applegate, Dr. Michael Edgmand, and Dr. David Henneberry for serving in this committee. Their support and suggestions were constructive and very helpful throughout the study.

To King Saud University, represented by the Saudi Arabian Cultural Mission to the U.S.A., I extend my sincere thanks. Without their encouragement and financial support this study would not have been accomplished. My appreciation is also extended to Dr. Hussein Samawi, my academic advisor at the Mission, for his continuous support, concern, and encouragement. I was lucky to have Mrs. Gloria Cook type my study. Thanks go to her for the expert typing.

I am in a great debt to my parents for their encouragement, support, understanding, patience, and unlimited love throughout my life. May God forgive and bless them. I am also grateful to my brothers, Abdulaziz, Abdulmohsin, Khalid, and Saad for their patience, kindness, and cheerfulness.

Special thanks are due to my wife, Hayat, for providing me with constant support and moral encouragement. Her patience, suffering, and sacrifices throughout this study were greatly acknowledged and appreciated.

To my son, Turky, and my two daughters, Shatha and Noha who gave such rewarding, endless love and were so patient with me I extend my thanks and appreciation.

I have been so fortunate to enjoy the real friendship of Dr. Abdulaziz Al-Duwais, Dr. Saleh Tawi, Ahmed Abobasha, Ahmed Salah, and many others. Their friendship, concern, and moral support are highly appreciated.

Finally, I extend sincere thanks to all members of my family in my beloved country, Saudi Arabia for their asking and concern about me. For them all I, humbly, dedicate this study.

TABLE OF CONTENTS

Chapter		Page
I.	INTRODUCTION	1
	Objectives of the Study	4
	Plan of the Study	5
II	THE ECONOMY OF SAUDI ARABIA	7
	Introduction	7
	Description of the Saudi Arabian Economy	9
	The Oil Sector	10
	The Non-Oil Sector	13
	Agriculture	13
	Industry	17
	Manufacturing	18
	The Foreign Trade Sector	19
	Exchange Rate History in Saudi Arabia	25
	Introduction	25
	Saudi Arabian Monetary Agency (SAMA)	29
	A Stabilization Program	30
	From the Dollar to the SDR Peg	32
	Exchange Arrangements	34
III.	LITERATURE REVIEW	40
	Introduction	40
	Fixed Vs. Flexible Exchange Rates	43
	Feasibility of Fixed Exchange Rates for Less Developed Countries	48
	Alternative Exchange Rate Regimes for Less Developed Countries	50
	A Single Currency Peg	51
	Pegging to a Basket of Currencies	55
	Pegging to the Special Drawing Rights (SDR)	57
	The Optimal Peg: A Comparative Analysis	59
	Determinents of International Trade Flows	65

Chapter Page

IV. METHODOLOGY AND EMPIRICAL RESULTS 73

A Simple Model of Saudi Arabian Foreign Trade 73
Aggregate Model 74
Aggregate Export Demand Function 74
Aggregate Import Demand Function 76
Effective Exchange Rate Calculations 77
Effective Exchange Rate Weighting Schemes 78
Disaggregate Model 79
Disaggregate Export Demand Functions 80
Disaggregate Import Demand Functions 81
Data Sources 83
Empirical Results 84
Aggregate Model 84
Aggregate Import Demand Function 84
Aggregate Export Demand Function 91
Disaggregate Model 98
Disaggregate Import Demand Functions 98
Disaggregate Export Demand Functions 106
Pooling the Data 113
Simulation of the Model 114
Simulation Results 115
Aggregate Model 115
Disaggregate Model 122

V. CONCLUSIONS 129

BIBLIOGRAPHY 134

LIST OF TABLES

Table		Page
2.1	Crude Oil Production and Oil Revenue	11
2.2	World Crude Oil Production	12
2.3	Agricultural Output and Its Share in GDP and Rate of Growth	15
2.4	Loans Granted by the Saudi Agricultural Bank	16
2.5	The Relative Importance of the Foreign Sector in Saudi Arabia	21
2.6	Imports from Major Partners	23
2.7	Export directions to Major Partners	26
2.8	A Summary of the Exchange Rate History	37
3.1	Special Drawing Right (SDR) Weights	58
4.1	Estimates of Saudi Arabian Aggregate Import Equations (Arithmetic Means)	85
4.2	Estimates of Saudi Arabian Aggregate Import Equations (Geometric Means)	86
4.3	Estimates of Saudi Arabian Aggregate Import Equations, Corrected for Autocorrelation (Arithmetic Means)	89
4.4	Estimates of Saudi Arabian Aggregate Import Equations, Corrected for Autocorrelation (Geometric Means)	90
4.5	Estimates of Saudi Arabian Aggregate Export Equations, (Arithmetic Means)	92
4.6	Estimates of Saudi Arabian Aggregate Export Equations, (Geometric Means)	93

Table		Page
4.7	Estimates of Saudi Arabian Aggregate Export Equations, Corrected for Autocorrelation (Arithmetic Means)	95
4.8	Estimates of Saudi Arabian Aggregate Export Equations, Corrected for Autocorrelation (Geometric Means)	96
4.9	A Comparison of the Estimated Elasticities of Aggregate Exports	99
4.10	A Comparison of the Estimated Elasticities of Aggregate Imports	100
4.11	Estimates of Saudi Arabian Bilateral Trade with the United States	101
4.12	Estimates of Saudi Arabian Bilateral Trade with Japan	102
4.13	Estimates of Saudi Arabian Bilateral Trade with West Germany	103
4.14	Estimates of Saudi Arabian Bilateral Trade with France	104
4.15	Estimates of Saudi Arabian Bilateral Trade with the United Kingdom	105
4.16	Estimates of Saudi Arabian Bilateral Trade with the United States (Corrected for Autocorrelation)	107
4.17	Estimates of Saudi Arabian Bilateral Trade with Japan (Corrected for Autocorrelation)	108
4.18	Estimates of Saudi Arabian Bilateral Trade with West Germany (Corrected for Autocorrelation)	109
4.19	Estimates of Saudi Arabian Bilateral Trade with France (Corrected for Autocorrelation)	110
4.20	Estimates of Saudi Arabian Bilateral Trade with the United Kingdom (Corrected for Autocorrelation)	111
4.21	Error Statistics for Projected Aggregate Imports Using Alternative Exchange Rate Regimes	116

Table		Page
4.22	Variances of Projected Aggregate Imports, Exports and Trade Balance Using Alternative Exchange Rate Regimes	119
4.23	Error Statistics for Projected Aggregate Exports Using Alternative Exchange Rate Regimes	120
4.24	Variances of Projected Saudi Arabian Imports from, Exports to and Trade Balance with the United States Using Alternative Exchange Rate Regimes	124
4.25	Variances of Projected Saudi Arabian Imports from, Exports to and Trade Balance with Japan Using Alternative Exchange Rate Regimes	125
4.26	Variances of Projected Saudi Arabian Imports from, Exports to and Trade Balance with West Germany Using Alternative Exchange Rate Regimes	126
4.27	Variances of Projected Saudi Arabian Imports from, Exports to and Trade Balance with France Using Alternative Exchange Rate Regimes	127
4.28	Variances of Projected Saudi Arabian Imports from, Exports to and Trade Balance with the United Kingdom Using Alternative Exchange Rate Regimes	128

LIST OF FIGURES

Figure		Page
1.	Exports and Imports of Saudi Arabia	22
2.	Saudi Imports from Major Partners	24
3.	Saudi Exports to Major Partners	27
4.	Saudi Riyal vs. Major Currencies	28
5.	Percent Appreciation or Depreciation Against the Riyal	35
6.	The Available Options of an Exchange Rate Regime	52
7.	Errors in Projected Aggregate Imports Using Different Currency-Pegs	117
8.	Errors in Projected Aggregate Exports Using Different Currency-Pegs	121

CHAPTER I

INTRODUCTION

Prior to 1973, the time of the breakdown of the Bretton Woods System, most countries, including the less developed countries (LDCs), adopted a fixed exchange rate regime. Under the Bretton Woods System, pegging to any currency meant having a fixed parity with all other currencies. Since 1973, each country has been free to choose the exchange rate arrangement that best met its goals.

It is widely agreed among economists that free floating of the currency is either infeasible or undesirable for most developing countries [See, for example, Diaz-Alejandro (1975), Black (1976), Crockett and Nsouli (1977), Lipschitz (1978), Bird (1979), and Williamson (1982)]. The reasons for such wide agreement are due to the characteristics of the less developed countries in general. For instance, these countries cannot influence their terms of trade significantly. That is because they are small countries and, by definition, they are price takers in the world markets. Second, they have an inelastic demand for imports and inelastic supply of exports in the short run. Third, they have a high degree of openness. The degree of openness influences the cost of adjustment to external shocks. Therefore, by choosing a fixed exchange rate, it will be much less expensive for those countries to adjust the entire domestic economy to an external shock[1]. Fourth, their trade is highly concentrated with

---

1 Heller, (1978)

one or a few partners. Thus, economic shocks in the trade partner(s) will be transmitted, to a large extent, to these countries. Thus, it is recommended that a small country should peg its currency to the currency of its major trading partner(s). This will ensure domestic price stability for a large part of its trade[2]. Fifth, their capital markets are rudimentary and, therefore, have a low degree of international financial integration. Hence, we expect those countries to choose fixed exchange rates in order to isolate the impact of the international capital movements on the predetermined targets of monetary policy[3].

With these facts in mind, an exchange rate system based on pegging, or some form of limited flexibility, would appear to be the most feasible policy for developing countries. The crucial issue is whether a developing country should peg its currency to another single currency or alternatively choose a basket peg. One example of a basket is the Special Drawing Rights (SDR). Currencies in a basket are usually weighted by imports, exports, or total trade. The weights of the currencies included in the SDR unit are determined by the International Monetary Fund (IMF).

Theoretically, the choice of an appropriate exchange rate regime for a country depends on the economic situation of that country. Since countries differ in their economic situations, we should not expect any one exchange rate regime to be appropriate for all of them at any one time.

As any other developing country, Saudi Arabia is characterized by a high degree of openness which can be defined as the ratio of imports to Gross Domestic Product (GDP). Therefore, its foreign trade and transactions play an essential and noticeable role in the economy. On the one hand, Saudi Arabia

---

2 Bird, (1979)

3 Heller, (1978)

is a large oil-exporting country, the largest in the world. For instance, in 1984 and 1985 exports totalled 129,794 and 99,536 million Saudi Riyals (S.R.), respectively. On the other hand, the country imports a very large proportion of its consumption needs (including machinery, medicine, cloth, and food) from the rest of the world. Again for 1984 and 1985, the imports of Saudi Arabia were 118,736 and 85,564 million S.R., respectively.

Developing economies, in general, are characterized by underdeveloped financial markets where interest rates are fixed by institutions and foreign exchange is highly controlled. For the oil-exporting economies, in particular, one might add that the trade balance plays a key role in the balance of payments. This means that these economies are connected to the world economy via international trade rather than via international capital movements. So, in this study, we will focus on the trade balance as representative of the balance of payments.

One of the most important macroeconomic variables, thought to be influenced by the choice of the exchange rate arrangements, is a country's trade balance. During 1970-1974, the Saudi Arabian economy experienced a continuous increase in its trade surplus which reached its peak of 116.59 billions Saudi Riyals in the year 1974. This surplus showed some fluctuations until the year 1979 when it started to increase rapidly and reached its new peak of 286.18 billions of Saudi Riyals in the year 1981. Beginning in 1982, the serious problem of falling prices of oil began. The trade balance surplus continued to decrease until it reached the lowest level of 3.60 billions Saudi Riyals in 1986.

Since the export of oil is priced in U.S. dollars, it may be natural for Saudi Arabia to peg its currency to the dollar. Following the Bretton Woods system Saudi Arabia continued to peg to the dollar until the mid-70's when the dollar became weak in the foreign exchange markets. At that time, Saudi Arabia switched its peg from the dollar to the SDR basket, which allows for some relative fluctuations among the exchange rates of the major currencies in the world. Thus, there was a change in the exchange rate regime in an attempt to stabilize the effective exchange rate. but it went back to pegging to $ in 1985 !!

Objectives of the Study

A number of studies have been conducted on the impact of the currency peg upon some macroeconomic variables. These studies include those by Black (1976), Crockett and Nsouli (1977), Lipschitz (1979), Flanders and Helpman (1979), Branson and Katseli-Papaefstratiou (1980), Lipschitz and Sundararajan (1980), Connolly (1982, 1983), and Melvin (1985).

All the studies mentioned above, aimed at selecting a peg to stabilize a particular variable. One may question the emphasis on the stability. Williamson (1982) in his "Survey of the Literature on the Optimal Peg" answered this question as follows:

> . . . movements between third currencies are regarded as disturbances that threaten to alter an exchange rate that has presumptively been set at an optimum level. Picking a peg is then viewed as the problem of minimizing the instability imposed by movements between third currencies that are noise as far as the domestic economy is concerned.

The objective of this study is to minimize the effect of third-country exchange rate fluctuations on the trade balance of Saudi Arabia. My aim is to stabilize the variance of the trade balance of the Saudi Arabian economy subject to the choice of exchange rate regime. Stabilization will be represented by the lowest variance of the trade balance.

The reasons for choosing the stability of the trade balance are twofold. First is the relative importance of the foreign trade sector to the Saudi Arabian economy. Second, there are a lot of fluctuations in the price of exports and imports (especially the price of oil). As known, movements in any exchange rate in a world of floating exchange rates will influence trade prices of all countries.

To accomplish this goal, a simple model representing the trade balance of the Saudi Arabian economy will be used. This model will include both the world demand of the Saudi exports and the Saudi import demand from the rest of the world. This model will also show the relative importance of the exchange rate in the foreign sector of the Saudi economy. The exchange rate will be one of the explanatory variables in the export and import equations. More details will be given in chapter IV.

Plan of Study

This study is divided into five chapters. Chapter I gives a brief introduction about the subject and, then discusses the objectives of this study. Chapter II describes the economy of Saudi Arabia. This description includes both the oil and non-oil sectors. In addition, it provides a historical background

about the exchange rate in Saudi Arabia. In particular, it focuses on the switch from the dollar to the SDR pegs and the reasons behind that.

Chapter III presents a literature review of most of the studies conducted in this subject. The main differences between fixed and flexible exchange rate are highlighted and the feasibility of adopting a fixed exchange rate by a less developed country is discussed. Moreover, the different kinds of exchange rate regimes available for a less developed country is presented. Furthermore, the optimal peg issue was discussed by many studies. Those studies will be reviewed and critically discussed.

Chapter IV describes the models used in this study. Then, the empirical results of this study is presented and analyzed. This chapter, also, describes the simulation of the model and provides its results on both aggregate and disaggregate levels.

Finally, Chapter V summarizes the main findings of this study for the estimation and simulation parts. Some policy implications and recommendations are included in this chapter.

CHAPTER II

THE ECONOMY OF SAUDI ARABIA

Introduction

It is well known that Saudi Arabia is the world's largest oil exporter. For instance, in 1988, Saudi Arabia contributed more than 25 per cent of total world oil production and more than 70 per cent of total OPEC production[1]. Moreover, Saudi Arabia possesses the world's largest reserves of oil. Third, Saudi Arabia's economic aid is considered to be one of the highest proportions, in terms of GNP, paid by any donor country.

Saudi Arabia's economy is dominated by oil. Of course, this dependence of the Saudi Arabian economy on oil revenues implies a long-run risk. This risk has become evident, especially, after the fall of oil prices in recent years. Therefore, Saudi Arabia planners have continuously emphasized the country's need for reducing its overwhelming dependency on oil revenues. This means that new policies which will lead to a more diversified economy must be adopted. The cornerstone of these new policies is to give increasing priority to the expansion of the non-oil sectors of the economy such as manufacturing industry, non-fuel minerals, and agriculture.

---

1 SAMA Annual Report, (1989)

The Saudi Arabian economy's history can be divided into four distinct periods or phases[2] . The first phase covered the period from 1932 (the unification of the country) to 1960 (the conclusion of the stabilization programme). Oil was discovered during this phase. It was the longest but the most difficult and challenging phase because of the economic backwardness of the country at that time. Some of the achievements of this phase were: the establishment of government machinery, the beginning of the foundations for education, health and welfare. The Saudi Arabian Monetary Agency (SAMA) was established in 1952 to carry out a strong monetary system and sound fiscal policy. During this period, government revenues increased from an estimated $7 million in 1938 to $351 million in 1960; a compounded annual rate of growth of about 20 percent.

The second phase covered the period from 1962 to 1972/73; prior to the first oil boom. During this period, it was announced that the Riyal would be a fully convertible currency. Although the First Development Plan did not start before 1970, this phase can be characterized by steady build up of the infrastructure. The educational, social, and economic development emphasized from the early stages of this phase. In order to promote diversification, agricultural and industrial development was promoted by providing facilities and incentives. Again, government revenues increased during this period to $3.9 billion; a compounded annual rate of growth of around 19 percent.

The third phase covered the period from 1973/74 to 1981/82, the second oil boom. That oil price boom yielded a huge amount of revenue which, in turn, provided the country with the resources needed for its development programs.

---

2 SAMA, Annual Report, 1403 (1983), p. 1

A vast infrastructure was begun immediately. The early years of this phase were very difficult for the Saudi economy because of problems associated with bottlenecks. Government revenues continued to increase reaching their peak of $107.8 billion in 1980/81 a compounded annual rate of growth of nearly 42 percent. At the end of this phase, the economy was transformed from a subsistence economy to a resource-rich rapidly growing economy.

Finally, the fourth phase begun in 1982/83 with the decline in oil income as a result of the continued decrease in oil prices. This was the major cause of the economy's declining oil revenues and consequently led to lower levels of government spending. Fortunately, this decline in oil income came at a time when Saudi Arabia had almost finished building a respectable infrastructure. During this phase, education and health are strongly supported. At the same time, infrastructure will not be emphasized as much as before. Encouraged by the government, the private sector is expected to play a leading role and replace the public sector as the main source of economic growth.

This chapter will be divided into two major sections. In the first section, I will provide a description of the Saudi economy by discussing the two main sectors of this economy (namely oil and non-oil sectors.) In the non-oil sector, I will discuss the agricultural, industrial, manufacturing and foreign trade sectors.

Description of the Saudi Arabian Economy

One of the main features of the Saudi economy is its dependence on government expenditures. The Saudi economy can be divided into two major sectors. Those sectors are the oil sector and the non-oil sector. The non-oil sector include agriculture, industry, manufacturing, and services.

The Oil Sector

Oil was discovered in commercial quantities in March of 1938, but large-scale development did not take place until World War II. Table 2.1 demonstrates the total and the average daily production as well as the total revenues from oil in Saudi Arabia during the period from 1968 to 1986.

Being the owner of the largest crude oil reserve in the world (almost 25 percent of total known reserves of crude oil in the world) gives Saudi Arabia a special role in the world economy. Until the year 1981, Saudi Arabia was the world's second largest producer of oil after the Soviet Union, with an average daily production of 9.9 million barrels per day in 1980. Starting from the year 1982, the average daily production declined so Saudi Arabia is the third largest producer of oil in the world after the Soviet Union and the United States of America. Table 2.2 shows the distribution of the world crude oil production for the years from 1978 up to 1986.

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, demonstrated clearly in Table 2.2. For instance, the oil revenue in 1973 was 4.34 billion dollars. As a result of the price increase, it became 22.57 billion dollars in 1974 and reached its highest level of 101.81 billion dollars in 1981.

Until the end of World War II, and even after, oil has been the source of revenues for both the private and public sectors. But, it is of interest to note that the oil sector is not an important source of employment. The reason is the nature of the oil industry itself which is a capital-intensive industry. Thus, the oil

TABLE 2.1

CRUDE OIL PRODUCTION AND OIL REVENUE

Year	Total[a] Production	Average Daily[b] Production	Total[c] Revenue
1968	1,113.7	3.04	926.4
1969	1,173.9	3.21	949.2
1970	1,386.7	3.79	1,214.0
1971	1,740.6	4.76	1,884.9
1972	2,202.0	6.01	2,744.6
1973	2,772.6	7.59	4,340.1
1974	3,095.1	8.47	22,573.5
1975	2,582.5	7.07	25,676.2
1976	3,139.3	8.57	30,754.9
1977	3,358.0	9.20	36,540.1
1978	3,038.0	8.32	32,233.8
1979	3,479.2	9.53	48,435.2
1980	3,623.8	9.90	84,466.4
1981	3,579.9	9.81	101,813.0
1982	2,366.4	6.48	70,478.6
1983	1,656.9	4.54	37,351.6
1984	1,492.9	4.08	31,470.3
1985	1,158.8	3.17	18,322.9
1986	1,746.2	4.78	13,554.8

[a] Million barrels
[b] Million barrels.
[c] Million U.S. Dollars

Source. SAMA Annual Report, different issues.

TABLE 2.2

WORLD CRUDE OIL PRODUCTION (THOUSAND BARRELS PER DAY)

	1978	1979	1980	1981	1982	1983	1984	1985	1986
World Total	60,335	62,812	59,670	56,028	53,751	52,777	58,105	57,620	60,190
Total OPEC	29,898	30,825	26,841	22,599	19,004	16,989	18,470	17,215	19,440
Total Non-OPEC	30,437	31,987	32,829	33,429	34,747	35,788	39,635	40,405	40,750
Saudi Arabia	8,292	9,535	9,900	9,808	6,483	4,539	4,080	3,170	4,780
USSR	11,428	11,703	12,010	12,176	12,251	12,225	12,450	12,150	12,515
U.S.A.	8,680	8,544	8,569	8,555	8,660	8,656	10,505	10,545	10,235
China	1,917	2,155	2,119	2,022	2,040	2,121	2,300	2,515	2,630
Canada	1,324	1,496	1,412	1,226	1,268	1,344	1,645	1,815	1,795
Mexico	1,207	1,461	1,936	2,312	2,746	2,665	3,015	3,015	2,745
U.K.	1,082	1,568	1,619	1,800	2,100	2,300	2,580	2,655	2,665

Source: SAMA Annual Report, different issues.

industry in Saudi Arabia employs a very small portion of the labor force of the country and uses the most advanced technology available for the industry. In fact, the oil sector employs no more than 1.6 percent of the labor force in both Third and Fourth Development Plans[3].

The Non-Oil Sector

The Saudi economy is developing a growing non-oil sector. Also, the sharp decline in the output of the oil sector in 1982, the relative share of the non-oil sector, has increased. Therefore, between 1970 and 1982, the share of the non-oil sector increased from 44 percent to 58 percent GDP. Between 1982 to 1985, the same share went up from 58 percent to 75 percent.

In this section, we will concentrate on the agriculture, industry, manufacturing, and services sectors.

Agriculture. Agricultural production in Saudi Arabia includes nomadic agriculture, settled farming, fishing, range resources and forestry. The agricultural sector is an important one in Saudi Arabia's development process. In fact it is regarded by the policy makers as integral part of economic diversification policy which aims to reduce the long-term dependence of the economy on oil.

Agriculture has benefited from the increased oil revenues in expanded markets, cost reduction in transformation, and to take advantage of modern inputs such as improved seeds, machinery, fertilizers, and so on.

---

3 Ministry of Planning, The Fourth Development Plan (Riyadh, Ministry of Planning, 1985), p. 86

Among the productive sectors in the Saudi economy, the agricultural sector is contributing significantly to the non-oil GDP. The rate of growth of this sector increased from 13 percent in 1986 to 14 percent in 1987. This yielded to a jump in the agricultural sectors' share of non-oil GDP from about 3 percent in 1982 to 10.7 percent in 1987. We can also observe the increasing importance of the agricultural sector by looking at Table 2.3. For example, the percentage share of that sector in the overall GDP was 3.3 percent in 1981. In 1986, the corresponding share was 6.8 percent.

This expansion of the agricultural sector is due to utilizing modern techniques, the transformation from small family-farming to large-scale commercial farming which uses modern means of production, and the noticeable government support to this sector which includes a system of subsidies for agricultural inputs and outputs, development of infrastructure, particularly agricultural roads and drainage system, and interest-free loans provided by the Saudi Agricultural Bank (See Table 2.4).

Some of the constraints on agricultural development in Saudi Arabia are the diverse climate conditions, scarcity of water, limited supplies of cultivable land, and labor force shortage. For example, agriculture in Saudi Arabia depends on groundwater because the country has no lakes, rivers or streams and there is not enough rain. Furthermore, the agricultural sector yields low income and has slow recovery of investment compared to the other sectors which makes people reluctant to invest in agriculture.

Employment in the agricultural sector is expected to grow by 7.4 percent during the Fourth Development Plan which covers the period 1985-1990. For example, in 1985 employment in the agricultural sector was 617.4 thousand

TABLE 2.3

AGRICULTURAL OUTPUT AND ITS SHARE IN GDP AND RATE OF GROWTH[a]

Year	Agricultural Output	% Share in GDP	% Rate of Growth
1970	984.1	5.7	----
1971	1,017.8	5.1	3.4
1972	1,050.1	4.6	3.1
1973	1,088.7	4.0	3.7
1974	1,129.6	3.6	3.8
1975	1,174.1	3.7	3.9
1976	1,221.0	3.5	4.0
1977	1,282.0	3.2	4.9
1978	1,483.0	3.5	15.6
1979	1,550.0	3.5	4.5
1980	1,639.0	3.3	5.7
1981	1,735.0	3.3	5.8
1982	1,835.0	3.4	5.7
1983	2,023.0	4.2	10.3
1984	2,286.0	4.7	13.0
1985	2,583.0	5.7	13.0
1986	2,919.0	6.8	13.0

[a] Millions of Saudi Riyals at constant prices of 1970.

Source: Saudi Arabian Monetary Agency (SAMA), Annual Report, different issues.

TABLE 2.4

LOANS GRANTED BY THE SAUDI AGRICULTURAL BANK

Year	Number of Loans	Value of Loans[a]
1970	4,356	16,134
1971	4,381	16,627
1972	3,865	16,558
1973	4,477	19,593
1974	5,414	36,304
1975	16,251	145,505
1976	19,702	269,433
1977	21,377	489,838
1978	20,298	585,668
1979	23,758	709,072
1980	19,782	1,128,686
1981	45,128	2,530,866
1982	37,446	2,932,902
1983	38,886	4,166,000
1984	23,884	3,496,000
1985	14,746	2,332,000
1986	9,209	1,551,000

[a] Thousands of Riyals.

Source: Saudi Arabian Monetary Agency (SAMA), Annual Report, different issues.

and it is expected to be 663.0 thousand in 1990. Therefore, employment in the agricultural sector was 13.9 percent in 1985 and is expected to be 15.7 percent of the whole civilian employment by 1990[4].

Industry. Saudi Arabia can not be classified as an industrial country. Industry in Saudi Arabia includes petroleum refining, steel production, and other industries that require large amounts of capital equipment to start production.

The industrial sector is one of the most critical sectors in the Third and Fourth Development Plans of Saudi Arabia. Thus, it has been assigned a considerable role in the realization of economic diversification and other growth targets of the development plans. The basic goal of Saudi industrialization is to foster the diversification of the economic base to achieve greater economic self-sufficiency and protection from external supply problems, and to benefit from domestic manufacturing activities[5].

The industrial sector in Saudi Arabia is still small relative to the other sectors. The government intends to undertake capital-intensive, long-term projects to develop only those industries in which it is most likely to have comparative advantages in the long-run. Therefore, two huge industrial complexes have been established in the cities of Jubail on the east province and Yanbu on the west province to be the cornerstone of the Saudi industrialization program. Those two complexes are to develop large-scale, hydrocarbon-based and energy-intensive industries such as petrochemicals, fertilizers, and iron and steel that can effectively utilize the huge supply of crude oil and its products.

---

4 Ministry of Planning, The Fourth Development Plan (Riyadh, Ministry of Planning, 1985), p. 86

5 El Mallakh and El Mallakh, (1982)

Manufacturing. Saudi Arabia's long-term future cannot depend on oil because it is nonrenewable resources. A fact understood by the government.

Between 1975 and 1980, the contribution of the manufacturing sector had doubled from SR 3,303.4 million to SR 6,753.3 million. During that period, the annual average rate of the manufacturing sector's contribution was nearly 5 percent of the non-oil GDP.

There are many manufacturing industries and hydrocarbon and cement plants are considered to be the largest two operations. Other manufacturing plants produce fertilizers, steel, copper wires, and cables. In the private sector, there are processing of foodstuffs, textiles, wood and paper.

Saudi Arabia is developing both hydrocarbon and non-hydrocarbon industries. The rationale for hydrocarbon-based industries, is to benefit from and make use of the abundant reserves of oil and gas as feedstock and energy. For non-hydrocarbon industries, it is necessary to have a wide industrial base by producing those kinds of commodities that the country is importing in large amounts such as food, chemical, metallic and non-metallic products.

Industrial sector development in Saudi Arabia faces some obstacles. Among them are the lack of technical and skilled manpower, the lack of technological and management know-how, and the reluctance of investors and businessmen to invest in this sector because they look after quick deals that give a quick profit. This quick profit will not be provided by Industries. Furthermore, one might add the lack of water as a major constraint in the industrialization of Saudi Arabia. Water availability in the long-run depends on the desalination process.

Finally, there is some dispute about the contribution of industries based on oil to the diversification of the sources of the Saudi income, and their ability to provide an alternative to the oil sector when it is depleted since these industries depends themselves on oil and natural gas. According to Dr. Farouk Akhdar, a Saudi economist and businessman, Saudi Arabia is pursuing these kinds of industries for three reasons. First, it is well known that the Saudi oil resources will not be effectively depleted before at least three generations. Second, these kinds of industries will help to create a new class of trained Saudi managers, entrepreneurs, and technicians who can be easily transferred to the other economic sectors as oil becomes less important. Third, these new industries will provide a wide range of ancillary industries and fabricating facilities to Jubail and Yanbu and will create new "growth poles" in the eastern and western provinces which will help to disperse economic activity regionally[6].

In order to provide financial support to the industrial sector, the Industrial Development Fund was established in 1974. This fund is established mainly to help finance new industrial projects undertaken by the private sector. The fund gives long-term loans with no interest which may cover up to 50 percent of the capital required for a project.

The Foreign Trade Sector. The Saudi Arabian economy can be characterized by its high degree of openness. International trade is the backbone of the economy and the oil sector plays a crucial role in terms of its contribution to the country's GDP, government revenues, and foreign exchange. Saudi Arabia is the world's leading exporter of crude oil.

---

6 El Mallakh and El Mallakh (1982).

The Saudi economy depends heavily on both exports and imports. This importance can be observed by looking at Table 2.5 which shows the proportion of imports and exports as well as the total trade to GDP for the period 1973-1986.

We can also demonstrate the importance of exports and imports in Saudi Arabia through Figure 1. This figure demonstrates total exports and imports of Saudi Arabia during the period 1979-1986 in billions of Saudi Riyals. Exports begun at a low level of 9.12 billions of RIs, and imports totaled 3.20 billions of RIs in the same year, 1970. Exports reached a peak of 405.48 billions of RIs in 1981 and imports reached its highest level of 139.34 billions of RIs in. It is easy to see from that figure that Saudi Arabia had its highest trade (exports minus imports) surplus ever of RIs 286.18 billions in.

Since this study concentrates on the five major economies (United States, Japan, West Germany, France, and The United Kingdom) for constructing the effective exchange rates of Saudi Arabia in Chapter III, we investigate Saudi trade with these five countries. On the import side, the highest portion of Saudi imports (until 1983) came from the United States. Specifically, in 1982, Saudi Arabia imports from the United States totalled RIs 29,193 millions. For the years 1984 and 1985, Japan was the leading exporter of Saudi Arabia. The United States gained back that position in 1986. On average the least important exporter to Saudi Arabia was France. Table 2.6 and Figure 2 demonstrate these trends in more details.

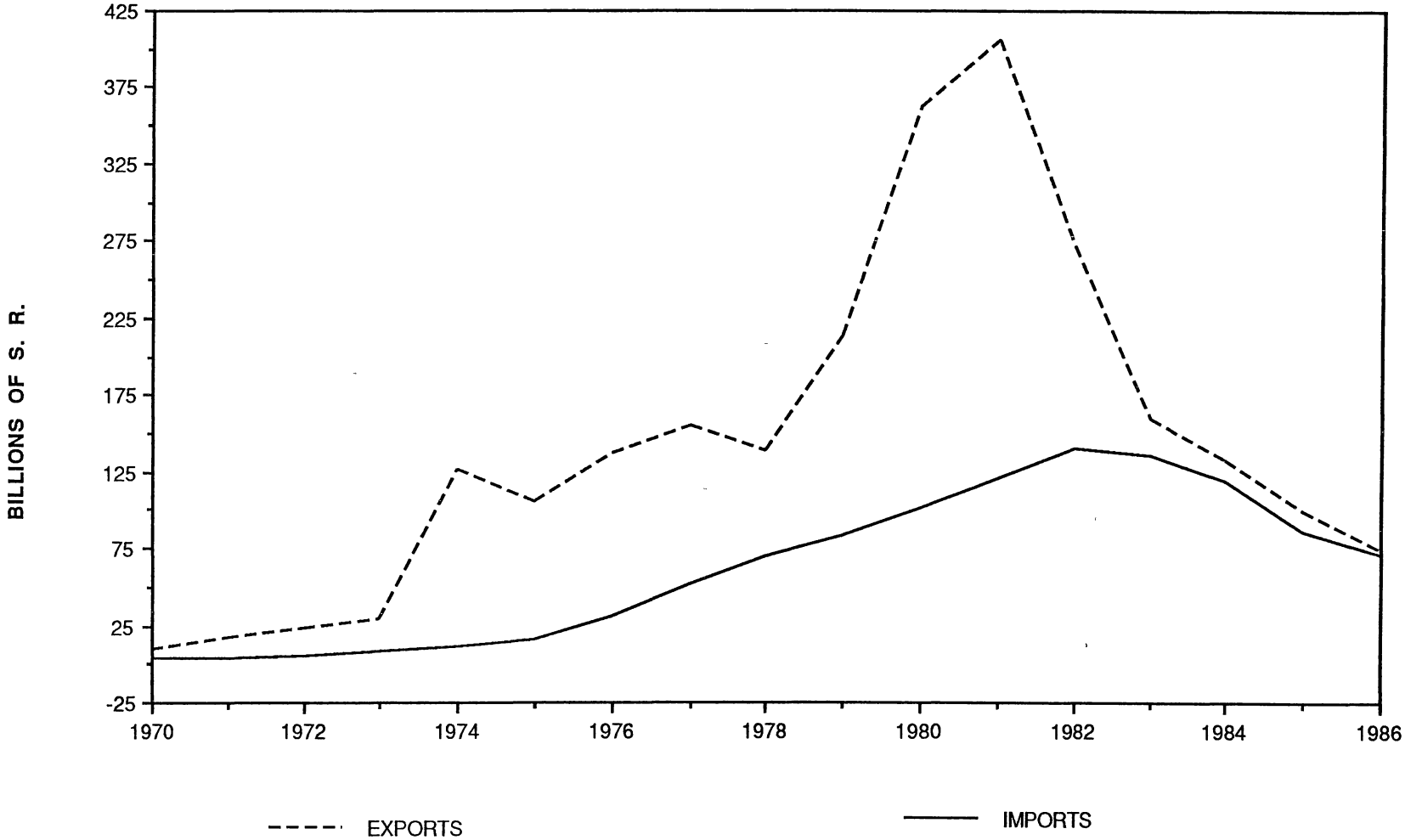
On the export side, Japan was the most important destination of Saudi exports which consisted extensively of oil. Saudi Arabian exports to Japan increased from the beginning of this period to reach its highest level of RIs 69,542 millions in 1981. The United States is second place, following the same

TABLE 2.5

THE RELATIVE IMPORTANCE OF THE FOREIGN SECTOR IN SAUDI ARABIA (BILLIONS OF S.R.)

Year	GDP	M	X	M/GDP %	X/GDP %	$\frac{M+X}{GDP}$ %
1973	40.55	7.31	28.92	18	71	89
1974	99.32	10.15	126.74	10	128	138
1975	139.60	14.82	104.47	11	75	86
1976	164.53	30.69	136.34	19	83	102
1977	205.06	51.66	158.81	25	78	103
1978	223.75	69.18	138.24	31	62	93
1979	248.41	82.22	213.18	33	86	119
1980	385.81	100.35	362.89	26	94	120
1981	520.59	119.30	404.44	23	78	101
1982	524.72	139.34	271.09	27	52	79
1983	415.23	135.42	158.44	33	38	71
1984	372.02	118.74	132.30	32	36	68
1985	326.84	85.56	99.54	26	31	57
1986	378.66	70.78	74.38	19	20	39

Source: International Financial Statistics, Year Book, 1988, pp. 612-3.



Source: International Financial Statistics, Annual Report, various issues.

Figure 1: Exports and Imports of Saudi Arabia (Billions of Saudi Riyals).

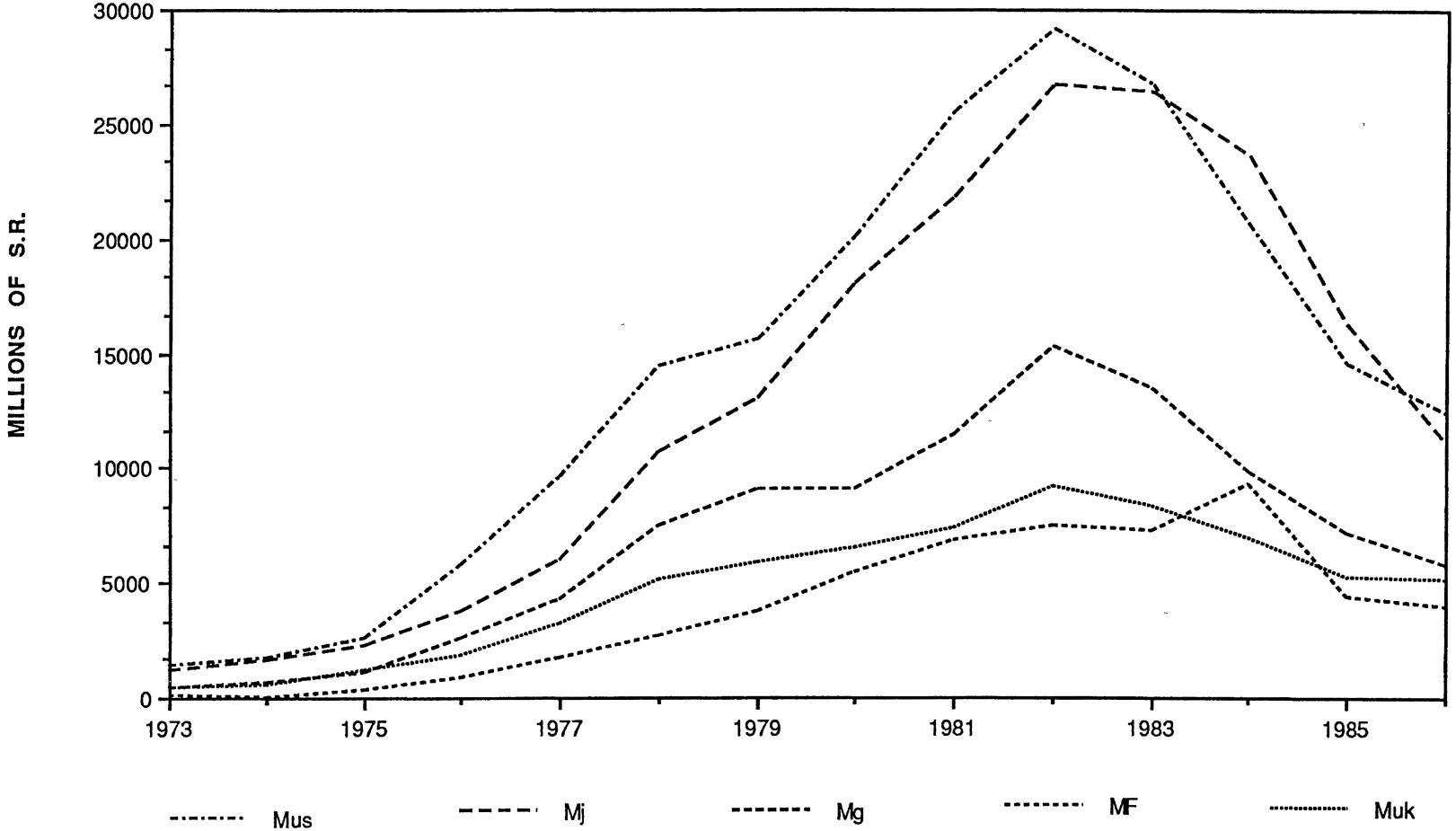
TABLE 2.6

IMPORTS FROM MAJOR PARTNERS
(IN MILLIONS OF SAUDI RIYALS)

Year	Mus	Mj	Mg	Mf	Muk
1963	343	141	101	28	135
1964	469	189	145	32	192
1965	680	260	181	53	177
1966	752	367	211	111	290
1967	837	275	231	82	221
1968	519	173	180	73	146
1969	621	347	266	122	302
1970	567	315	315	90	230
1971	615	413	287	81	328
1972	916	676	294	108	344
1973	1,440	1,133	458	156	466
1974	1,735	1,616	612	18	491
1975	2,538	2,267	1,017	332	1,147
1976	5,739	3,731	2,538	821	1,815
1977	9,621	5,981	4,320	1,728	3,182
1978	14,434	10,659	7,467	2,668	5,093
1979	15,581	13,021	9,024	3,754	5,841
1980	20,086	17,992	9,112	5,440	6,504
1981	25,567	21,825	11,395	6,843	7,407
1982	29,193	26,658	15,310	7,451	9,166
1983	26,735	26,367	13,471	7,232	8,376
1984	20,655	23,568	9,861	9,252	6,898
1985	14,529	16,221	7,192	4,359	5,280
1986	12,352	11,131	5,747	3,990	5,151

Source: SAMA, Annual Report, various issues.

Note:
- M_{us}: imports from the United States
- M_j: imports from Japan
- M_g: imports from W. Germany
- M_f: imports from France
- M_{uk}: imports from the United Kingdom



Source: SAMA, Annual Report, Various Issues.

Figure 2: Saudi Imports From Major Partners.

pattern with a peak of RIs 55,866 millions in 1980. This comparison can be illustrated and observed from Table 2.7 and Figure 3 in more detail. From these statistics, we can observe the importance of the United States and Japan as the two major trading partners whose currencies are having an important impact upon the effective exchange rate of the Riyal.

Exchange Rate History in Saudi Arabia

Introduction

The exchange rate is an important policy instrument. It plays a crucial role in influencing the internal price of tradable goods relative to nontradable goods, the price of exports or import substitutes relative to the cost of producing these goods. It also affects the domestic currency price of imports relative to the price of domestic substitutes. Furthermore, it affects the foreign currency price of a country's export relative to the export of prices of its competitors.

The choice of an exchange rate policy is a crucial issue in Saudi Arabia for, at least, two reasons. First, a "market-clearing" exchange rate is widely considered to be inappropriate in an oil exporting developing countries, because most of them have underdeveloped financial markets. Therefore, some alternatives must be searched for. Second, since Saudi Arabia is concerned with diversifying the structure of exports, and lessening the dependency on oil exports, the exchange rate becomes particularly important for efforts in this direction.

The Riyal (the Saudi Arabian currency) continued to be stable with respect to major currencies in the world during the 1970s. This fact is well illustrated by Figure 4. Nevertheless, this stability has become an increasingly difficult task because of the high degree of instability in the international currency markets

TABLE 2.7

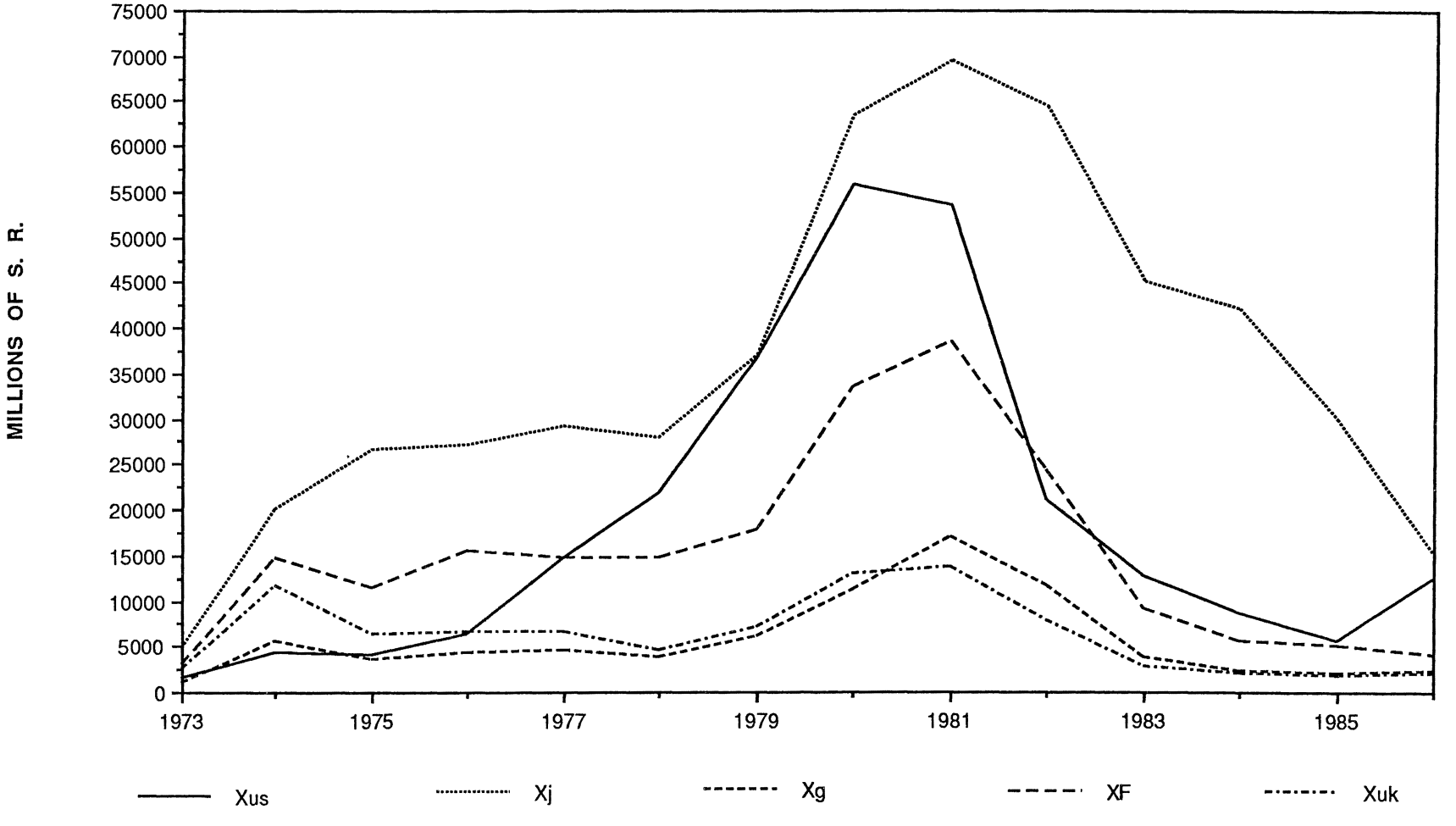
EXPORT DIRECTIONS TO MAJOR PARTNERS
IN MILLIONS OF SAUDI RIYALS

Year	Xus	Xj	Xg	Xf	Xuk
1963	352	1,132	315	150	154
1964	388	1,336	522	170	138
1965	476	1,525	536	200	319
1966	430	1,752	584	223	450
1967	260	2,110	828	320	695
1968	196	1,639	362	386	482
1969	234	2,732	243	414	779
1970	99	2,322	221	693	828
1971	588	2,782	579	1,665	1,512
1972	1,127	3,444	738	2,110	1,844
1973	1,625	4,940	1,102	3,061	2,651
1974	4,417	20,135	5,541	14,570	11,755
1975	4,031	26,483	3,659	11,290	6,271
1976	6,377	27,097	4,238	15,582	6,618
1977	14,575	29,080	4,435	14,704	6,491
1978	21,771	27,881	3,779	14,776	4,678
1979	36,753	36,983	6,022	17,856	7,097
1980	55,866	63,274	11,029	33,525	12,844
1981	53,439	69,542	16,987	38,640	13,795
1982	21,127	64,434	11,656	24,321	7,741
1983	12,696	45,059	3,738	9,236	2,857
1984	8,741	42,130	2,327	5,573	1,914
1985	5,465	29,820	2,122	4,984	1,873
1986	12,393	15,137	2,208	4,133	2,094

Source: SAMA, Annual Report, various issues.

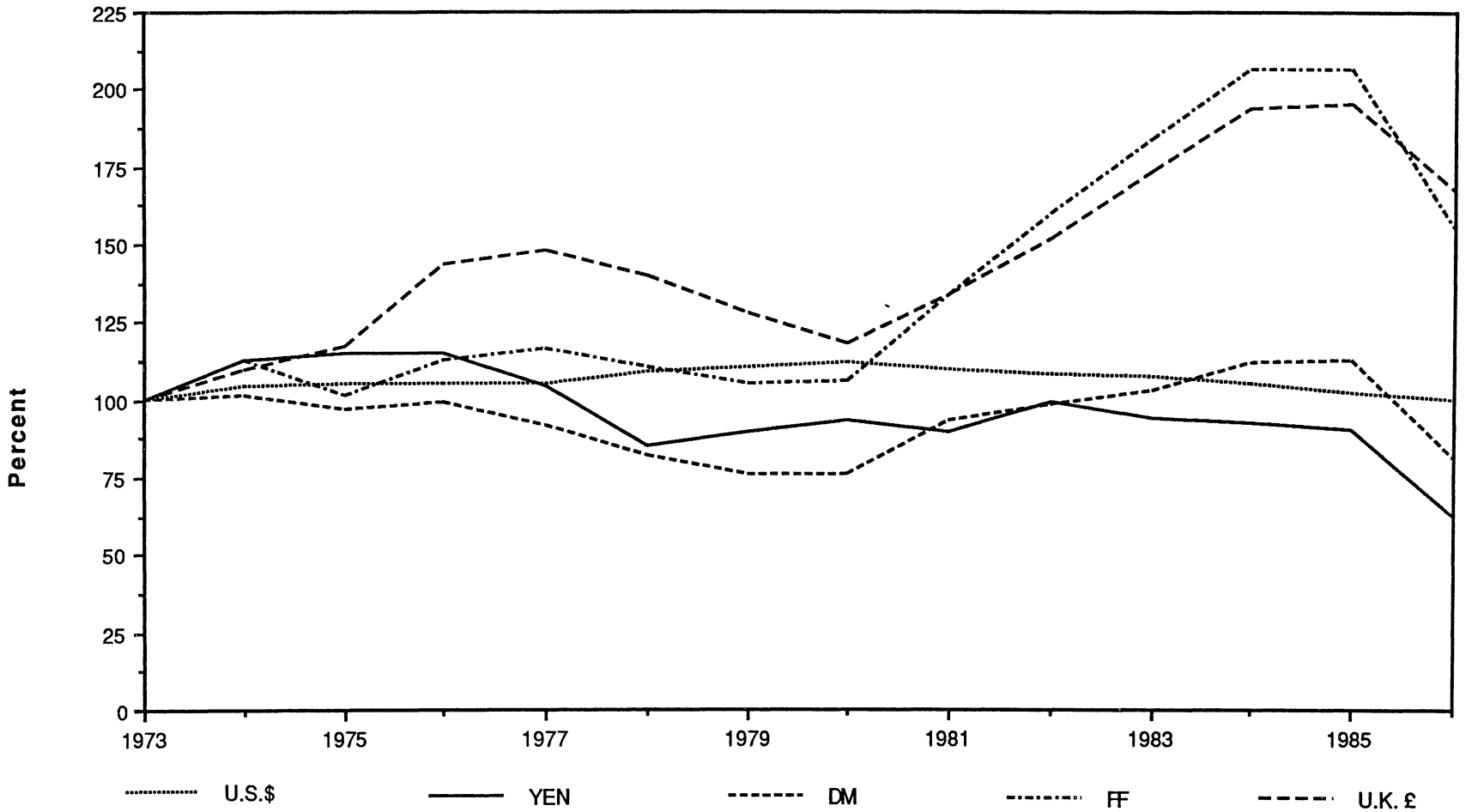
Note:

X_{us}: exports from the United States
X_j: exports from Japan
X_g: exports from W. Germany
X_f: exports from France
X_{uk}: exports from the United Kingdom



Source: SAMA, Annual Report, Various Issues.

Figure 3: Saudi Exports to Major Partners.



Source: The data needed for this figure was taken from the International Monetary Fund: International Financial Statistics, Annual Report, 1988.

Figure 4: Saudi Riyal VS. Major Currencies

and the sometimes side fluctuations daily in the exchange rates of major currencies.

This section is devoted to discussing the main monetary events since the beginning of the 1950s, and to highlight the history of the Riyal. In the next section, I will describe the operation of the Saudi Arabian Monetary Agency (SAMA) which serves as the central bank for Saudi Arabia. Then, changes in the currency of Saudi Arabia will be mentioned. Next, the financial difficulties of the 1950s and the stabilization program will be discussed. After that, the history of pegging the Riyal to one of the major currencies in the world; such as the U.S. Dollar, the Japanese Yen, the Dutche Mark, the French Franc, and the Pound Sterling, or to the Special Drawing Rights (SDR) will be traced and the justification of each peg will be clarified.

Saudi Arabian Monetary Agency (SAMA)

Under the hard economic environment of the postwar economy, the Saudi Arabian Monetary Agency (SAMA) was inaugurated on Saturday, October 4, 1952. SAMA was established to oversee the money and banking system in Saudi Arabia. Some of its major responsibilities are:

- issuing the country's legal currency.
- receiving and paying funds on behalf of the Government.
- acting as custodian of the country's monetary and foreign exchange reserves.
- regulating, strengthening and consolidating the country's commercial banking system.

At the time of SAMA's establishment, the country's monetary system had a mixed coin-oriented silver standard. First of all, there were the Saudi Silver Riyals and curpo-nickel coins. Along with that, a number of foreign currencies circulated, particularly the British gold sovereign. Yet, the Saudi Silver Riyal was the most popular coin and considered the cornerstone of the country's currency system. In addition, during the pilgrimage season, some foreign paper notes circulated. Therefore, one of the first tasks of SAMA after its establishment was to complete the country's monetary system.

In early 1952, SAMA issued the first Saudi Arabian gold coin to replace the British sovereign and eliminated foreign currencies out of circulation. After that, introducing decimal coinage and paper currency was implemented. For instance, and as an experiment with paper currency, Pilgrim Receipts were issued on July 23, 1953. The Pilgrim Receipts were generally popular and so accepted among people. Because of the high success of these receipts as paper currency, SAMA was highly encouraged to issue an official paper currency in June 1962.

A Stabilization Program

In the mid-1950's, the Saudi Arabian economy experienced some financial difficulties which resulted in a depreciation in the free market rate of the Riyal, then depletion of the country's foreign exchange reserves to the very low level of $2.72 million in January 1958. Hence, some exchange controls were imposed. A stabilization program was suggested to improve the country's financial and economic position, to increase SAMA's foreign reserves and to strengthen the Riyal.

The implementation of the stabilization program led to eliminating all exchange controls and to stabilize the exchange rate of the Riyal at RIs 4.50 per one dollar as of January 8, 1961. On March 22, 1961, Saudi Arabia accepted formally, the obligations of convertibility under Article VIII of the Articles of Agreement of the International Monetary Fund. After the completion of the Stabilization Program, the Riyal remained constant with respect to the dollar for almost ten years.

SAMA is emphasizing that it will always stand for maintaining a stable par value for the Riyal:

> . . . .it may be important to stress that it is the considered policy of the Saudi Arabian Government to hold the par value of the Riyal stable. Since a major objective of national policy is to accelerate economic growth and to build a diversified productive base to reduce the country's dependence on oil which is a depleting asset, it is considered that the most appropriate exchange rate policy for the country is undoubtedly to hold the value of the Riyal stable.[7]

On December 18, 1971, the Smithsonian Agreement was reached. According to this agreement, major currencies in the world were realigned. For instance the dollar was devalued by 7.89 percent. As a result, the Saudi Arabian Government reviewed the situation very carefully and decided to maintain the par value of the Riyal in terms of gold at 0.197482 gram of fine gold per Riyal. Therefore, the Riyal appreciated by 8.57 percent with respect to the dollars; from RIs 4.5 to RIs 4.14475 per dollar.

---

7 Saudi Arabian Monetary Agency (SAMA), Annual Report, 1972/1973, P. 33.

Another devaluation for the dollar took place in February 1973 as a result of the continued international monetary crisis. Due to that devaluation, the Riyal appreciated by 11.11 percent with respect to the dollar, from RIs 4.14475 to 3.73027 per dollar. Furthermore, the dollar was devalued in August 1973 and, as a result of that, the Riyal appreciated by 5.08 percent, from RIs 3.73027 to RIs 3.55001 per dollar. In sum, the Riyal appreciated by a total of 26.76 percent against the dollar during a period of less than two years; from RIs 4.50 to RIs 3.55 per dollar. On the first two occasions, the government of Saudi Arabia decided to maintain the par value of the Riyal in terms of gold at 0.197482 gram of fine gold per Riyal. However, because of continued international monetary crisis and a decline in the value of the dollar with respect to the currency of Saudi Arabia's major trading partners, the government raised the par value of the Riyal by 5.08 percent; from 0.197482 to 0.207510 gram of fine gold per Riyal.

From the Dollar to the SDR Peg

The fluctuations mentioned in the last section among the major currencies in the world caused uncertainty in the international foreign exchange markets. In the first quarter of 1975, the dollar depreciated against the other major currencies. An evaluation of the government's exchange rate policy was carried out. Until that time the Riyal was, for operational convenience, linked or pegged to the dollar.

The official view of the government at that time was that the Riyal should not be fixed against any currency. The justification for such a view was that if such a relationship was maintained the Riyal would fluctuate widely against other currencies. That kind of movement may bear no relation to the domestic

economy. On March 15, 1975, and as an alternative solution of this problem, the Riyal peg was changed from the dollar to the SDR basket which was calculated daily by the IMF on the basis of a weighted average of rates for 16 major currencies[8]

The practical implication of pegging the Riyal to the SDR is that the daily exchange rate between the Riyal and any other currency will be determined on the basis of the daily exchange rate between that currency and the SDR announced by the IMF. Pegging to the SDR implies two essential steps: (i) determine a parity with the SDR, and (ii) ensure that the available margins of up to 2.25 percent on each side of parity are not violated.

There were many reasons which prompted the Saudi Arabian authorities to sever the link of the Riyal with the dollar and repeg to the SDR. First, it was felt that the objective of having a stable Riyal could be best attained by pegging the Riyal to the SDR. Second, the Riyal would not be exposed to wide fluctuations in any single currency. Third, the policy adopted was to stabilize the exchange rate of the Riyal with respect to the SDR with a band of 7.25 percent on each side of the SDR/Riyal parity of SDR1 = RIs 4.28255. If this wide margins are utilized, they will help insulate the Riyal from extraordinary fluctuation in the SDR itself as a result of undesirable speculative forces which might contradict the development policies of the Saudi Arabian economy.

On March 15, 1975 the exchange rate between the dollar and the Riyal was $1 = RIs 3.47 compared to the previous rate on August 11, 1973 of $1 = RIs 3.55. This implied an appreciation of 2.3 percent. If compared to the pre-

---

8 It is only for five major currencies, the U.S Dollar, the Dutche Mark, the Japanese Yen, the French Frank and the Pound Sterling.

Smithsonian parity of $1 = RIs 4.50, it will yield an appreciation of 29.7 percent for the Riyal.

Exchange Arrangements[9]

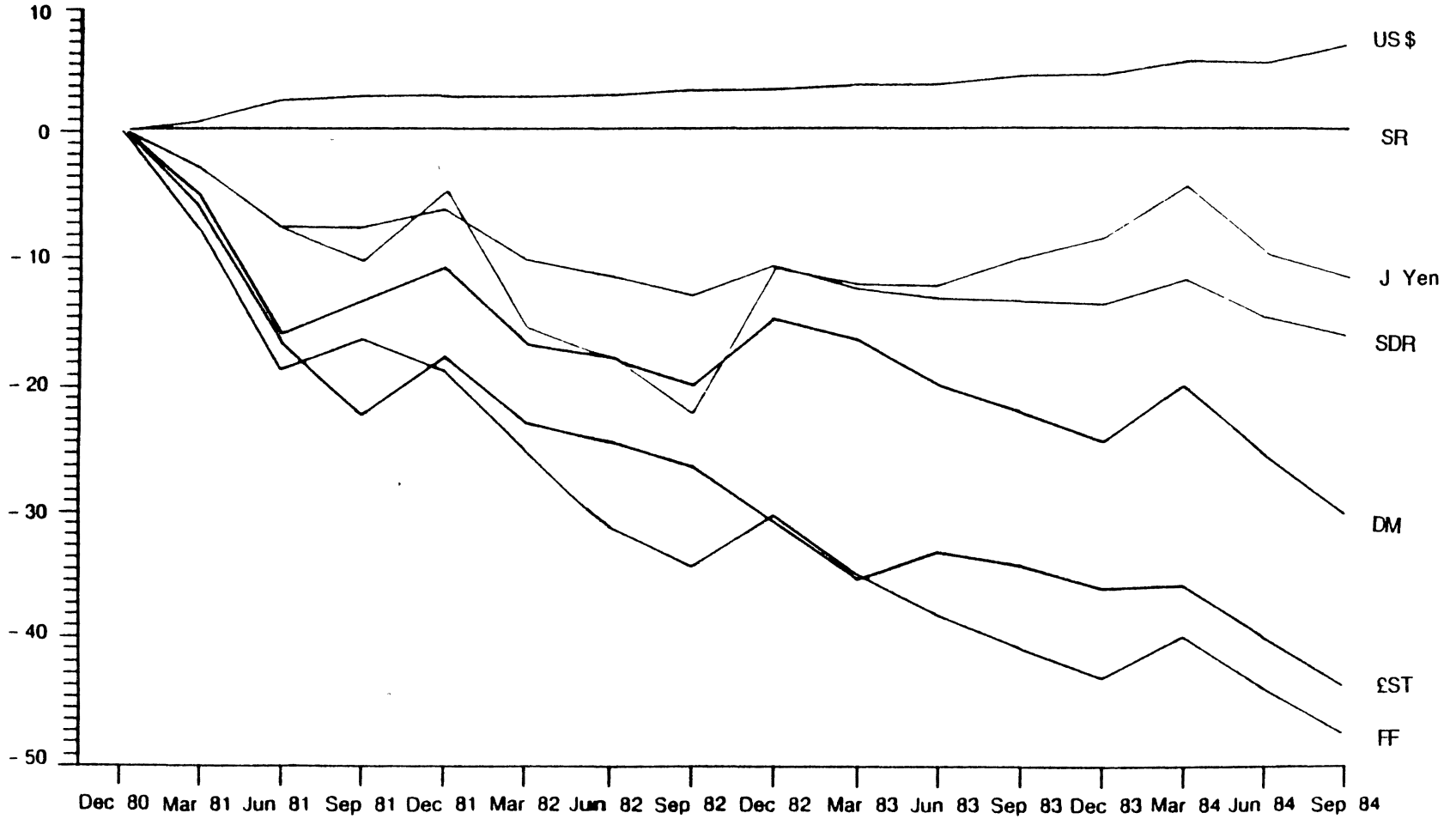
The Saudi Arabian Riyal is now pegged to the SDR, as mentioned in the last section, at RIs 4.28255 = SDR1, with a band not exceeding 7.25 percent on either side. Saudi Arabia uses the U.S. dollar as its intervention currency. SAMA determines the middle rate of the Saudi Arabian Riyal for this intervention currency on the basis of the IMF's daily calculation of the U.S. dollar/SDR rate. On December 31, 1987, SAMA's middle rate was U.S.$1 = RIs 3.750 buying rate from banks was U.S.$1 = RIs 3.740.

Although the Riyal continued to be stable with respect to major currencies in the world, this stability is becoming an increasingly difficult task because of the volatility of exchange rates in the international currency markets. Figure 4 illustrates the development of the exchange rate between the Saudi Riyal and major currencies.

The relative stability in the exchange rate of the Riyal was achieved by a "desired" degree of downward adjustment against the dollar joined by a significant upward adjustment against the other major currencies and the SDR[10]. A graphical demonstration of that is shown in Figure 5. This figure illustrate the percent appreciation on depreciation of the major currencies against the Riyal for the period December 1980 - September 1984 with quarterly data. Due to the greater importance of the dollar in the foreign exchange transactions of Saudi Arabia, we can see from Figure 5 that the

---

9 IMF, Exchange Arrangements and Exchange Restrictions", Annual Report, 1988, p. 423
10 SAMA, Annual Report, 1984



Source: This figure is adopted from SAMA's Annual Report, 1984.

Figure 5. Percent Appreciation or Depreciation Against the Riyal (Base = December 1980).

degree of the Riyal depreciation with respect to the dollar was smaller compared with that of appreciation with respect to other currencies.

As for the impact of exchange rate policy on inflation, we note that import prices expressed in foreign currency; went down because of the decline in inflation in Saudi Arabia's trading partners. At the same time, there was an appreciation in the exchange rate of the Riyal against most major currencies. These two factors reinforced each other resulting in a decline in imported inflation.

In summary, exchange rate developments in Saudi Arabia are shown in Table 2.8. The table shows the different par values followed by Saudi Arabian. It also illustrates the importance of the U.S. dollar, as an intervention currency.

TABLE 2.8

A SUMMARY OF THE EXCHANGE RATE HISTORY

	Aug. 23 1971	Dec. 21 1971	Feb. 21 1973	Aug. 11 1973	Mar. 15 1975	Dec. 31 1975	July 31 1977	Oct. 23 1977
Par Value (Gold)[a]	0.197482	0.197482	0.197482	0.207510				
Par Value (SDR)[b]				4.5	4.28255	4.28255	4.28255	4.28255
Actual SDR/RI Rate				4.4187	4.2709	4.2709	4.1156	4.1156
Middle Rate ($)[c]	4.5	4.14475	3.73027	3.55001	3.470	3.53	3.525	3.515
Selling Rate for $		4.15	3.735	3.555	3.475	3.535	3.530	3.52
Buying Rate for $		4.14	3.725	3.545	3.465	3.525	3.520	3.51

TABLE 2.8 (continued)

	Nov. 23 1977	Dec. 31 1977	Jan. 3 1978	July 7 1978	Nov. 5 1978	Dec. 12 1978	Dec. 31 1979	Dec.31 1980
Par Value (Gold)[a]								
Par Value (SDR)[b]	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255
Actual SDR/RI Rate	4.1156	4.1156	4.2563	4.2563	4.2563	4.2563	4.3422	4.3299
Middle Rate ($)[c]	3.505	3.495	3.445	3.245	3.365	3.295	3.365	3.325
Selling Rate 3.33 for $	3.51	3.50	3.45	3.25	3.37		3.30	3.37
Buying Rate 3.32 for $	3.50	3.49	3.44	3.24	3.36		3.29	3.36

TABLE2.8 (continued)

	Dec.31 1981	Dec. 31 1982	Dec. 31 1983	Dec. 31 1984	Feb. 1985	March 1985	June 1985	Dec.31 1986	Dec.31 1987
Par Value (Gold)[a]									
Par Value (SDR)[b]	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255	4.28255
Actual SDR/RI Rate	4.9885	4.7847	4.6931	4.6119	4.6777	4.6777	4.6777	4.3446	4.8446
Middle Rate ($)[c]	3.415	3.435	3.495	3.575	3.595	3.605	3.645	3.745	3.745
Selling Rate for $	3.42 3.75	3.44	3.50	3.58	3.60	3.61	3.65	3.75	
Buying Rate for $	3.41 3.74	3.43	3.49	3.57	3.59	3.60	3.64	3.74	

Sources: IMF, "International Financial Statistics", various issues.
IMF, "Exchange Arrangements and Exchange Restrictions, Annual Report",Vols. 23-29, 1972-1988.

[a] Grams of fine gold per Riyal.
[b] Riyals per one unit SDR.
[c] The U.S. Dollar is used as an intervention currency.

CHAPTER III

LITERATURE REVIEW

Introduction

Exchange rate fluctuations allegedly impact adversely developing countries more than developed countries. There are many reasons behind this including the following. First, trade of developing countries is usually paid in foreign exchange. This will cause uncertainty facing the traders because the foreign exchange markets in these countries are not well developed. Another reason is that when a developing country pegs its currency to that of another developed country, a preference for bilateral trade with this country may affect its multilateral trade with other countries and may damage its comparative advantage. It is the case that for most developing countries debt is largely denominated in a single currency. Therefore, its value is likely to change as a result of fluctuations in exchange rates among developed countries[1].

In a world of generalized floating exchange rates, most of the developing countries have chosen to peg their currencies to some relatively stable standard. Lipschitz and Sundararajan (1980) gave various reasons for this behavior[2]. They argued that exchange rates are determined in an asset market the prices of which tend to fluctuate sharply. There are some real

[1]IMF, Occasional Paper #28.
[2]Lipschitz and Sundararajan, Finance & Development, June 1980

economic costs associated with such fluctuations. For example, these fluctuations may inhibit trade, destabilize domestic prices, and increase uncertainty. Since prices of traded goods are affected by the exchange rate, changes in relative price of traded to home goods are likely to have an adverse impact on the allocation of investment. Furthermore, fixing the exchange rate will provide a built-in reserve cushioning effect which will reduce the impact of short-term real shocks (for example, a crop failure).

While a central bank's holding of foreign reserves may work as a shock absorber in a pegged exchange rate system to insulate a developing country from domestic real shocks, it will not work very well to insulate the economy from foreign monetary shocks. Yet, a small developing country can, to some extent, minimize the impact of undesired foreign monetary shocks by choosing an appropriate currency peg. Thus, the choice of peg is seen as the appropriate policy instrument to minimize the adverse consequences of exchange rate fluctuations on the economy. Several studies looked at the undesirable consequences as the induced instability of some target variables and, then, the choice of peg will be to insulate (or stabilize) these variables from the effects of exchange rate fluctuations among the major world currencies.

The choice of an appropriate exchange rate regime should be directed by the objectives of the country under consideration. It also depends on the nature of the problems faced by this developing country. For instance, some of the Latin American countries have followed the crawling peg system hoping to maintain a specified rate of inflation vis-a-vis the inflation rates of their trading partners[3].

---

[3]Bacha (1979).

Most of the conclusion of the studies during the 1970s were derived in an ad hoc manner from the optimum currency area literature (a striking feature of which is their limited empirical work). In recent years, theory has advanced to include the nature of exogenous shocks to the domestic economy as determinants of exchange rate system. The recent theoretical literature concerning the choice of an exchange rate system has concentrated on how selection of an exchange rate regime will affect the stability of the economy.

It is worth noting at this point that there is a wide agreement among those studies reviewed here that the choice of an exchange rate regime should be conducted with the aim of stabilizing a variable instead of the aim of optimizing (maximizing or minimizing) a specific variable[4]. But, why concentrate on the stabilization issue? Jhon Williamson (1982) answered this question as follows:

> . . . because movements between third currencies are regarded as disturbances that threaten to alter an exchange rate that has presumptively been set at an optimal level. Picking a peg is then viewed as the problem of minimizing the instability imposed by movements between third currencies that are noise as far as the domestic economy is concerned.

Since different studies have different target variables for the choice of exchange rate system, it is likely that these studies will yield different recommendations as to how the peg should be chosen. This last issue will be clear in the next section of this chapter.

---

[4]Williamson (1982).

This chapter will discuss most of the literature written about the optimum currency peg. In the next section, the main differences between fixed and flexible exchange rates are discussed. How feasible are fixed exchange rates for less developed countries will be answered in the following section. Then, the alternative exchange rate regimes for less developed countries are analyzed. The last section will discuss some of the major criteria to select the optimum currency peg.

Fixed vs. Flexible Exchange Rates

The discussion of fixed versus flexible exchange system is based on two strands of the economic literature[5]. The first one is the theory of optimum currency areas. This theory emphasizes different factors in determining whether a developing country should have a fixed or flexible exchange rate system. Among these factors are the degree of openness, commodity diversification, geographical concentration, degree of capital market integration, relative rate of inflation, and the source of disturbances. This theory was derived from the classic article by Mundell (1961). Excellent surveys concerning this theory was done by Ishiyama (1975) and Tower and Willet (1976). The other is the optimal peg theory based on the substantial analysis done by Black (1976) where he emphasized the diversification of trade as a major determinant of this choice.

There are substantive differences among the various studies in terms of the methodology and emphasis of the different theoretical arguments. Thus, it is likely that the choice of exchange rate system may change according to the objective function used. For example, Fischer (1977) and Frenkel and

---

[5]Nasimento (1987)

Aizenman (1982), trying to minimize real consumption shocks, concluded that the greater the domestic money shocks, the more likely is a float. The opposite conclusion was reached by Flood (1979) and Aizenman (1983) with an objective of minimizing domestic price shocks. They found that a fixed exchange rate is more preferred.[6].

A country can let its currency float freely when it allows its exchange rate to be determined in the foreign exchange markets. This necessitates well developed exchange and financial markets. For such a policy to be effective in terms of minimizing the variance of domestic prices, Black (1976) insists that the major shocks to the economy should be exogenous changes in world price relative to domestic prices or from exogenous changes in exchange rates. Thus, if the major shocks are a result of internal disturbances such as crop failures, then this type of policy will not be optimal.

By floating its currency freely, a country will enjoy some benefits. For example, it will be more likely to have a continuous adjustment in the balance of payments. Distortions which may result from artificial fluctuations in the exchange rate or from direct controls on trade and capital flows will be reduced. Furthermore, internal policy objectives will be persuaded with some extra freedom. Finally, the costs of reserve holdings will be reduced.

The theory of optimum currency areas provides the theoretical bases for identifying the relevant determining factors of exchange rate policy. Tower and Willett (1976) stated that:

> "The theory of optimum currency areas provides theoretical insights that --- force researchers to attack the issues not in the abstract all-

---

[6]Melvin (1985)

or-none terms of much of the debate over fixed versus floating rates, but rather in terms of the search for the major factors that influence the relative desirability of alternative exchange rate systems."[7].

Therefore, researchers are encouraged to examine the exchange rate problem not only to choose between fixed and flexible regime; but rather to isolate major determinants affecting the relative desirability of alternative exchange rate regimes.

As a result, it is not surprising that most of the studies conducted to discuss the determinants of exchange rate flexibility before 1976 were of a theoretical nature with a limited empirical work. A striking feature of the recent literature is that before deciding on the exchange rate regime, an analytical method of describing exchange rate policy will be developed [See Heller (1977); Dreyer (1978); Bird (1979); Holden, Holden and Suss (1979); Melvin (1985) and Bosco (1987)].

To choose between fixed or flexible exchange rates, a number of guidelines are provided by theory (mainly, the theory of optimum currency areas). Heller (1977), through his discriminant analysis, tested a wide variety of factors that are likely to affect a country's selection of an exchange rate system. His objective of the analysis was to identify those characteristics which allows us to differentiate most effectively between peggers and floaters. Another useful task of his analysis was to detect whether any country is "misclassified" in that it does not use the exchange rate system used by most countries with similar characteristics. Heller concluded that pegging tends to be significantly associated with a high degree of openness (i.e. a high import

---

[7]Holden, Holden and Suss (1979)

to GNP ratio); a high degree of commodity concentration, a low inflation rate, a small size, and a small ratio of foreign assets to the money supply. Floating will be associated with the opposite characteristics.

In a similar study, Dreyer (1978) pointed out that a country's size, its degree of openness, and geographical and structural diversification of its foreign sector are the major determinants of its exchange rate arrangements. Dreyer supported partially the conclusion reached by Heller (1977). He found that a small size and a high degree of openness are characteristics associated with pegging. At the same time, and in a contradiction to Heller, he found that the high trade concentration to be a characteristic associated with floating.

Bird (1979) examined more carefully the countries characteristics from a theoretical point of view. He emphasized, at least, three additional points to the previous studies. These three points are the elasticity of foreign trade, the origin of economic disturbances and the level of reserves. Bird drew his conclusion concerning this issue as:

> What may be said is that, in theory, if LDCs could legitimately be typified as being open, nondiversified economies which possess low foreign trade elasticities, and generate most economic disturbances internally, then a fixed exchange rate might seem preferable to a floating rate. For closed, diversified economies which have high trading elasticities and low levels of reserves, however, a flexible exchange rate might generally be advocated.

Holden, Holden and Suss (1979) have developed an indicator of the flexibility of exchange rate policy which enables them to study this issue from an analytical rather than an institutional point of view. This indicator can also

be used to test the relative importance of some factors indicated by the theory of optimum currency areas in determining the appropriate exchange rate system. For instance, they found openness, trade concentration and capital mobility to be negatively related to exchange rate flexibility. The degree of economic development, the product diversification of exports and divergence in inflation rates were found to have a positive effect on exchange rate flexibility.

It is clear that these studies are complementary and their outcome are generally consistent with our expectations derived from the traditional optimum currency areas literature.

The recent theoretical literature on the choice of an exchange rate system has focused on another type of factors. Melvin (1985), for example, emphasized the role of the nature of the disturbances to the economy. He indicated, using a standard open economy macro model, that the magnitude of money shocks and foreign price shocks are major determinants of exchange rate system. Melvin (1985) went on to state;

> . . . it is the magnitude of the shocks that determine exchange system choice and not the other factors that essentially serve as proxies for the susceptibility to such shocks.

Thus, if we account for the shock effects, these other factors suggested by the theory of optimum currency areas will be insignificant[8].

Melvin (1985), derived two testable conclusions:

---

8 Melvin, (1985), P. 477

1. The greater the foreign price shocks, the more likely a flexible exchange rate.

2. The greater the domestic money shocks, the more likely a fixed exchange rate.

Feasibility of Fixed Exchange Rates for Less Developed Countries

It is widely agreed among economists, that free floating of the currency is either infeasible or undesirable for most developing countries [See, for example, Diaz-Alejandro (1975), Black (1976), Crockett and Nsouli (1977), Lipschitz (1978), Bird (1979), and Williamson (1982)]. This conclusion is based on the special structure and the economic characteristics of these countries. For example, these countries cannot influence their terms of trade significantly. That is because they are small countries and, by definition, they are price takers in world markets. Consequently, they have no influence over the price of traded goods and the exchange rate.

Another point, which is directly related to the last one is that both their demand for imports and supply of exports are inelastic in the short run. A third point is that they have a high degree of openness. The degree of openness influences the cost of adjustment to external shocks. Therefore, by choosing a fixed exchange rate, it will be much less expensive for these countries to adjust the entire domestic economy for an external shock[9].

Fourth, their trade is highly concentrated with one or a few partners. The major economic shocks in the trade partner economies will be transmitted to a

---

9 Heller, (1978)

high extent. Thus, it is recommended that a small country should peg its currency to that of its major trade partner(s). This will ensure a domestic currency price stability for a large part of its trade[10].

Fifth, their capital markets are rudimentary and, thus, have a low degree of international financial integration. Hence, we expect these countries to choose fixed exchange rates to isolate the impact of the international capital movements on the targets of monetary policy[11].

In conclusion, it appears that an exchange rate system based on pegging or some form of limited flexibility would be the most feasible policy for developing countries.

Crockett and Nsouli (1977) argued that due to their stage of development, the majority of developing countries could experience large costs of floating at the beginning. This is mainly because of the inefficiency of their foreign exchange markets in stabilizing exchange rate fluctuations. They predicted that the costs of these fluctuations may not be accepted by the authorities, especially when they adversely affect economic growth objectives.

This idea was supported by Lipschitz (1979). He suggested that a developing country should adopt a fixed exchange rate regime. He based his suggestion on the fact that exchange rate fluctuations will probably be exacerbated because of the small size of the markets of their currencies.

From the previous discussion, one may derive a conclusion that shows the limits imposed upon the choice of developing countries of their exchange

---

10 Bird, (1979)

11 Heller, (1978)

rate system. These limits are consequences of the characteristics of these countries and the theory of optimum currency areas.

Oil exporting economics share most of these characteristics. Therefore, they do not opt for floating exchange rates. In addition to the more general arguments mentioned earlier, there are some issues related to this group of countries. For example, some oil exporting developing countries experience a high degree of international capital movements as a result of relatively high private savings[12]. Second, they have limited domestic investment opportunities. Third, exchange control is absent. Finally, and may be most importantly, unexpected world oil price changes are contributing to the fluctuation of exchange rate.

Alternative Exchange Rate Regimes for Less Developed Countries

In a world of generalized floating exchange rates, it is not enough to solve the problem of exchange rate policy by determining whether to peg or float the currency under consideration. It is also necessary to choose to what major currency to peg. Pegging can be defined as maintaining the domestic currency within a well-defined range relative to some other currency or group of currencies. It implies accepting fluctuations not only against all other floating currencies but also against non floating currencies that are pegged using another type of arrangements.

Each of the various pegging policies and arrangements has its own costs and benefits. This will be clear in the following subsections of the chapter. Therefore, it is very important, for any country, to study carefully the pros and

---

12 Amuzegar, (1983)

cons of each policy and regime before reaching any conclusion about the most suitable one for it to adopt.

There are many different types of exchange rate regimes that a less developed country may adopt. For instance, it may choose to peg its currency to a single major currency such as the U.S. dollar, the Japanese yen, the U.K. pound, the Deutsche mark, and the French franc. It may also choose to peg its currency to a basket of currencies. In this case, a country has the choice of adopting an available basket, such as the special drawing rights (SDR). Finally, it may choose a basket peg that is composed of the currencies of its major trade partners. This type of basket is usually weighted with an appropriate weight such as imports, exports, and total trade.

Figure 6 illustrates the different choices of an exchange rate system available to any country (developing or developed country). This study will emphasize the lower half of that figure which demonstrates the different types of currency peg available to those countries who choose to peg their currencies.

A Single Currency Peg

Under this regime, a developing country links its currency to one of the major currencies in the world. Then, the value of its currency will be determined in terms of that major currency. This type of arrangements implies that the value of the currency will change vis-a-vis currencies of the rest of the world when the value of the currency to which it is pegged changes. A single currency peg appears to be the option most favored by less developed countries. For instance, as of March 31, 1988, there were 59 single-peg

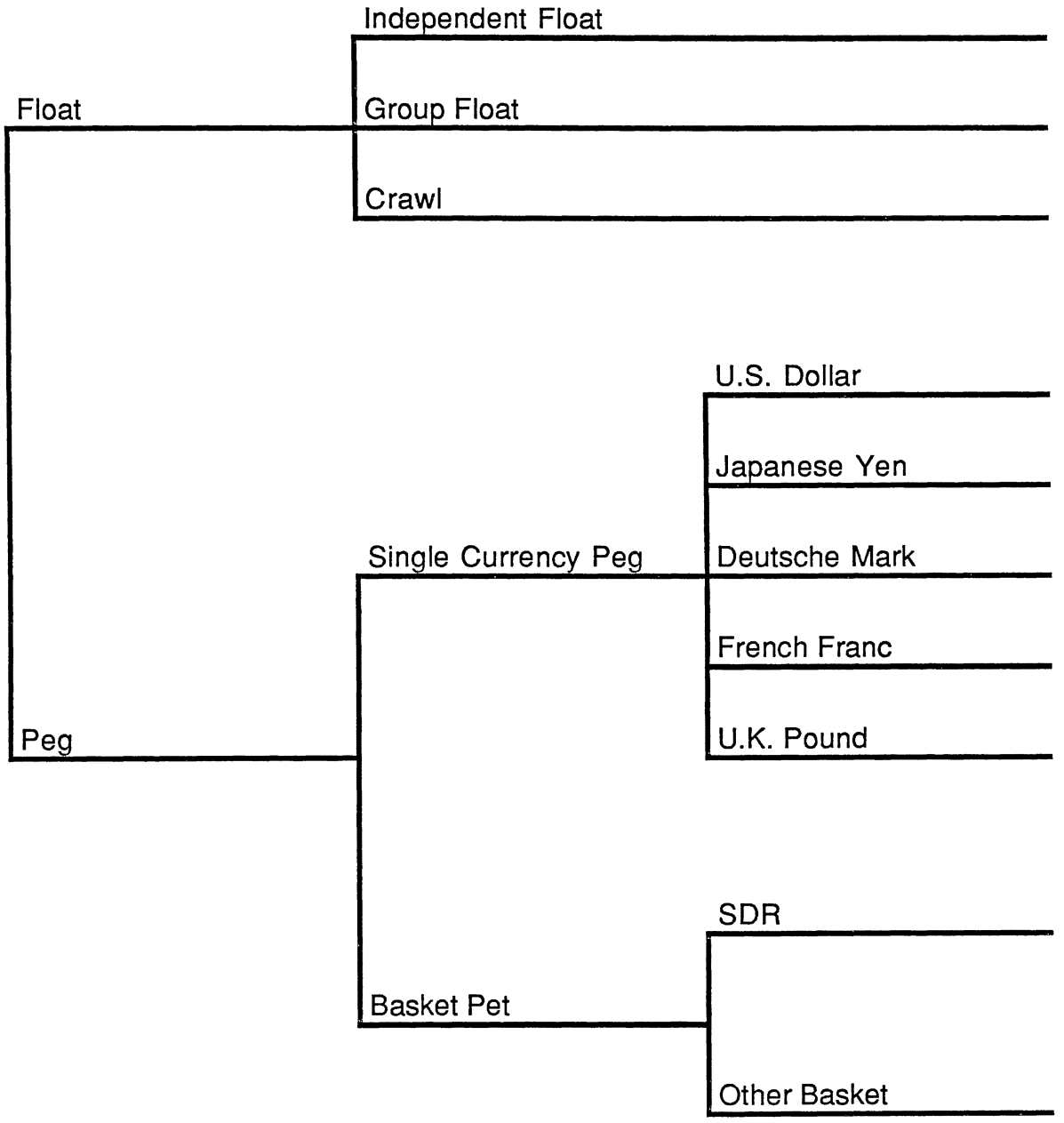


Figure 6. The Available Options of an Exchange Rate Regime.

countries; 40 with the U.S. dollar, 14 with the French franc, and 5 with different other currencies[13].

A single currency peg is usually attractive to developing countries that have a tied trade and financial relationship mainly with a single trading partner. Among other things, simplicity of applying this kind of exchange rate regime makes it attractive to developing countries.

When a developing country pegs its currency to a single major currency, it also, and at the same time, floats with respect to other currencies (including the currencies of small countries that are pegged to other major currencies). In other words, the fluctuations in the nominal exchange rate could be divided in two parts. The first one is the change in the rate at which the currency is pegged to the major currency. The second part is attributed to changes in the relationship between this major currency and the other major currencies in the world.

Pegging to a single currency may yield advantages to the pegging country some of which are:

1. A single currency peg may reduce the fluctuations of the exchange rate between the less developed country and the currency-peg country under consideration. This will increase trade between the two countries as a result of the decreasing uncertainty in their relative currency values.

2. Since the developing country's currency is linked to a well sound currency, it will gain some confidence. Consequently, foreign

---

[13]IMF, International Financial Statistics, Year Book, 1988.

investment will improve to increase the capital inflows which means, at the end, an improvement in the balance of payments.

3. Under a single currency currency peg, a developing country will gain an access to forward exchange facilities.

Pegging to a single currency involves various potential disadvantages. Some of these disadvantages are:

1. Under a single currency peg, not all developing countries peg to the same major currency. Therefore, it is likely that the exchange rates between their currencies will show some degree of variation. This is apparently clear when, for instance, a group of them are engaged in intra-regional trade to benefit from the advantages of market size.
2. The needs for reserve will increase under a single currency peg. This is because a developing country must have a specific amount of foreign reserves to be used during intervention to support the value of its currency.
3. There is a possibility of having higher import prices from countries other than that to whose currency the developing country is pegged.
4. When a developing country pegs its currency to a major currency, and the exchange rate of that major currency has fluctuated, this might adversely affect the economy of this developing country. For example, an appreciation in the currency peg may deteriorate unemployment, production level and, consequently, balance of payments.

Pegging to a Basket of Currencies

In an attempt to overcome the problems involved in pegging to a single currency, some less developed countries may choose an approach which maintains the advantages of pegging while minimizing the disadvantages. It will be the best alternative in the case of having more than one major trade partner.

Under this type of regimes, the exchange rate of the pegging currency will be determined by the exchange rates of the currencies composing the basket. To clarify this idea, it will be explained by an example. Suppose a small developing country, Saudi Arabia, chooses to peg its currency, the riyal, to a basket including two currencies, the dollar and the yen. Suppose the basket that has been chosen includes $1.00 and Yn 1.00. Initially, let us assume that the cross exchange rates:

$1.00 = Yn 2.00, $1.00 = S.R. 200, Yn 1.00 = S.R. 100

The value of this basket, then, will be S.R. 300. As an implication of this policy, the value of the riyal will either appreciate or depreciate with respect to the dollar whenever the value of the yen with respect to the dollar changes. The change in the value of the riyal will be about one-third. So, if the yen depreciates by 3 per cent with respect to the dollar, this means that the riyal will depreciate by nearly 1 per cent with respect to the dollar; an appreciation of nearly 2 per cent with respect to the yen.

From the previous illustrative example, we may observe the importance of the weights of the currencies included in the basket. Since the major currencies in the world are floating independently, it is not easy to determine

the net effect of their fluctuations on a country's exchange rate. Therefore, the effective exchange rate may be used to determine this net effect. The effective exchange rate (EER) can be defined as the value of the domestic currency in terms of a weighted group of currencies relative to a chosen base period[14].

There are different types of weights used to construct the EER. These weights are based on imports, exports, or total trade. Crockett and Nsouli (1977) argue that, for less developed countries, the import-weighted index yields the best result among the three mentioned above. Their reasoning is based on the type of goods produced by both developed and developing countries. On the one hand, developing countries produce and export primary commodities which are not homogeneous (no uniform international price prevails). Therefore, changes in the exchange rates of developed countries vis-a-vis a developing country will affect the payments of developing countries for imports from developed countries.

As any other policy, pegging to a basket of currencies has some shortcomings. According to this regime, each developing country is free to choose among different types of baskets. Therefore, cross exchange rates between all developing countries that use such baskets will vary. Another shortcoming of pegging to a basket of currencies is its adverse impact upon the foreign investment. It is hard in this case, for the foreign investors, to predict the value of each developing country's currency. Consequently, they will hesitate to invest in such a country, which means that this country becomes less attractive for foreign investment and may experience balance of payments problems. Finally, to determine the composition of the currency basket, the authorities of a developing country have to face problems such as

---

14 Mohtadi, (1988)

data and other problems associated with weighting schemes. They also have to come up with the best compromises between objectives[15].

Pegging to the Special Drawing Rights (SDR)

In order to overcome some of the problems of constructing and adopting separate baskets of currencies for each country a number of developing countries have chosen to peg their currencies to a common numairaire called the Special Drawing Rights (SDR). The SDR was introduced the IMF in 1969 to be the fund's official unit of account. At the beginning, the SDR was equivalent to the U.S. dollar. After 1973, the value of the SDR was determined by a basket of 16 currencies weighted by the relative importance of their countries in the volume of world exports. In 1981, this basket was changed to include only five major currencies; the U.S. dollar, the Japanese yen, the West German mark, the French franc and the U.K. pound. Table 3.1 illustrates the currencies included in the SDR unit and their relative importance (weights).

Pegging to the SDR is a much simpler matter compared to pegging to a basket of composite currencies. It has two components: determine a parity with the SDR, and ensure that there is no violation of the specified margins for the percentage change of the exchange rate around that parity.

Pegging to the SDR yields many benefits. For instance, it will stabilize the cross exchange rates among all other currencies that use the SDR peg. Thus, for a regional group of countries seeking a monetary integration, it might be preferable to choose the SDR as a common peg (the GCC countries make a good example).

---

15 Wickham, (1985)

TABLE 3.1

SPECIAL DRAWING RIGHT (SDR) WEIGHTS

Currency	July 1974-June 1978	July 1978-Dec 1980	Jan 1981-Dec 1985	From Jan 1986
U.S. dollar	33.0	33.0	42	42
Deutsche mark	12.5	12.5	19	19
Japanese yen	7.5	7.5	13	15
French franc	7.5	7.5	13	12
Pound sterling	9.0	7.5	13	12
Canadian dollar	6.0	5.0		
Italian lira	6.0	5.0		
Netherlands guilder	4.5	5.0		
Belgian franc	3.5	4.0		
Swedish drona	2.5	2.0		
Australian dollar	1.5	1.5		
Danish krona	1.5	...		
Norwegian krone	1.5	1.5		
Spanish peseta	1.5	1.5		
Austrian schilling	1.0	1.5		
South African rand	1.0	...		
Saudi Arabian riyal	...	3.0		
Iranian rial	...	2.0		
Total Weight	100	100	100	100

Source: IMF "The role of the SDR in the International Monetary System," Occasional Paper, no.51, March 1987, pp.54.

Pegging to the SDR is also useful in terms of reducing fluctuations in the effective exchange rate and domestic prices, especially when the trade weights of the major trade partners are close to their weights in the SDR. In general, one can say that the SDR pegging will be more efficient the closer the weights of the SDR basket from the trade weights for the major trade partners.

From a practical point of view, nobody can deny the convenience and simplicity of adopting the SDR peg. The IMF computes and publishes the value of the SDR unit on a daily basis.

At least two shortcomings of the SDR-peg can be mentioned. First, for this type of peg to operate properly, a developing country should choose an intervention currency because the SDR, by itself, is not a currency[16]. Second, as Crockett and Nsouli (1977) argue, pegging to the SDR is probably less efficient than pegging to an import-weighted basket in terms of reflecting the movements in the EER.

The Optimal Peg: A Comparative Analysis

Many studies have been conducted on the optimum (best) exchange rate regime for a developing country. Each study follows a specific criterion (criteria) to make that decision. For instance, Crockett and Nsouli (1977), Flanders and Helpman (1979), and Lipschitz and Sundararajan (1980) used the trade balance (or current account) as their deciding factor. Crockett and Nsouli (1977) and Flanders and Helpman (1979) looked at the level of aggregate demand (and thus output and employment). Furthermore, the inflation rate was emphasized by Crockett and Nsouli (1977) and Connolly

---

16 Yousef, (1981)

(1982, 1983). Some studies, such as Flanders and Helpman (1979), Branson and Katseli-Papaefstratiou (1980), Black (1976), and Lipschitz (1979) considered the relative price of traded goods, and thus the allocation of resources.[17]

In 1976, Stanley Black conducted what is considered to be the pioneering analysis of exchange rate policies for developing countries in a world of generalized floating. He used the familiar dependent economy model of "internal and external balance" for less developed countries. Black addressed the question of stabilization with respect to external and internal shocks. Then, he used the variance of the domestic relative price of traded goods to be the main measure of stability. He also thought that the stability of the EER, resource misallocation, reserve needs, and institutional requirements are among the factors that should be taken in consideration before choosing between a basket peg and a single currency peg. Finally, he concluded that a basket peg will be preferred for the purpose of external as well as internal balance, providing that the benefits of pegging to a basket outweigh its costs.

Crockett and Nsouli (1977) compute the divergence of the SDR basket peg and of a single currency peg (the U.S. dollar, the U.K. pound, and the French franc) from the import-weighted basket for a number of developing countries for the period from January 1970 to March 1975. Their suggested goal was to stabilize balance of trade and output, by stabilizing EER. They recommend pegging to an import-weighted basket, while investigating the importance of the SDR as a good proxy for that import-weighted basket.

---

[17]Williamson (1982)

Flanders and Helpman (1979) develop a more formal model compared to the early studies. They explore exchange rate policy for an economy that is small (price taker) in every respect but faces a downward-sloping demand curve for its export good. For the purpose of choosing a currency basket, they concentrated on two objectives. The first objective was to minimize the variance of the balance of trade subject to the constraint that there be some predetermined rate of improvement in the balance of trade itself. They stress that a number of countries which have utilized basket pegs were aiming for stability in the balance of payments. The second objective was to minimize the variance of real income subject to a requirement on its expected level.

Lipschitz (1979) based his study on a model of a small country that has no influence on its terms of trade for the sake of establishing an optimal basket for pegging. He investigated the performance of the Indian rupee's real exchange rate by employing four types of hypothetical baskets. So, his target was to stabilize the real effective exchange rate (i.e. reduce its fluctuations). He argued that the choice of a currency peg will affect income distribution, the internal terms of trade, and the allocation of resources.

Terms of trade fluctuations are thought to play an important role in income instability in many developing countries. Branson and Katseli-Papaefstration (1980) decomposed these fluctuations into three main components: (a) shifts in world market conditions, (b) shifts in home market conditions, and (c) changes in exchange rates. They investigated the appropriateness of a basket peg in terms of a country's net-export-side market power, and came up with a weighting formula that would count for variations in third country's exchange rates on the home country's terms of trade.

Branson and Katseli-Papaefstratiou's (1980) goal was to stabilize the terms of trade. Thus, they introduced policies to minimize the variance in the terms of trade. Assuming that many developing countries experience some degree of market power (especially, in the export side), they can influence their terms of trade. Branson and Kateseli-Papaefstratiou (1980) encouraged these developing countries to use that power to peg to a basket that will lead to stabilizing their terms of trade.

Lipschitz and Sundararajan (1980a) continued on the model of Lipschitz (1979). They emphasized the stabilization of real EER and argued that this will minimize the impact of exchange rate fluctuations on the economy. They recommended pegging to an elasticity-weighted basket which is not, in general, optimal because the derived optimal weight of the currency in the basket and the preassigned elasticity weight are not always the same[18].

According to Lipschitz and Sundararajan, the studies by Branson and Katseli-Papaefstratiou (1980) and Flanders and Helpman (1979) are not complete because they do not include relative price movements. To take these movements into consideration, Lipschitz and Sundararajan conducted two different studies (1980b and 1980c) to generalize those studies of Branson and Katseli-Papaefstratiou (1980) and Flanders and Helpman (1979). They investigated and derived the weighting system that will yield minimizing the variance of the balance of trade (1980b). They also derived the optimal basket weights that will result in stabilizing the terms of trade (1980c).

Connolly (1982) looked at this problem in a monetary context with rational expectations. He addressed the following questions:

---

18 Williamson (1982)

> To which, if any, of two reserve currencies, say the U.S. dollar and the pound sterling, should a small open country peg in order to best insure domestic monetary stability (e.g. stable home prices)? Or, in general, is a basket peg composed of the two currencies preferable to a single currency peg?

While central bank holdings of foreign reserves to maintain a fixed exchange rate may protect the economy from domestic real shocks, Connolly (1982) argued that a currency peg does not protect from foreign monetary shocks. Thus, he believes that, a small country may reduce the impact of unwanted foreign monetary shocks by choosing the best currency peg. He emphasized three types of external shocks to the domestic rate of inflation: (a) changes in relative prices, (b) imported inflation, and (c) deviations in exchange rates from Purchasing Power Parity.

Connolly's main problem was to minimize the level and variability of inflation. So, his concern was from a monetary stability point of view and his criteria for this were both the level and stability of the rate of inflation. Connolly (1983) applied this analysis to the case of the Latin American countries. His empirical results suggest that the dollar peg was the best for Latin American countries in comparison to the other single currencies or even to the SDR.

An empirical study generalizing the work of Connolly was done by Yousef (1981) for the case of fifteen Arab countries. The decision to be made in his case was choosing the pegging policy which will result in a more stable domestic inflation rate. He considered the standard deviation in that rate to be the measure of stability. Yousef found that if a country has one major trade partner, then a single currency peg appears preferable. Because oil exports

domestic inflation rate. He considered the standard deviation in that rate to be the measure of stability. Yousef found that if a country has one major trade partner, then a single currency peg appears preferable. Because oil exports share is a large percentage of total exports of the oil-exporting countries and because oil exports is priced in terms of the dollar, he suggested that a dollar peg, as compared to other single currency pegs, would yield the most stable pegging policy in terms of the standard deviation in the domestic inflation rate of those oil-exporting countries.

Furthermore, he concluded that systematic stability, as measured in terms of the standard deviation either in inflation rates or in money growth rates of currency peg countries, is considered an important factor in determining optimum currency pegs for the sample country.

Melvin (1985) chose his target to minimize the unexpected fluctuations in the domestic price level. He developed a standard open economy macro model to emphasized the importance of the magnitude of money shocks and foreign price shocks as major determinants of exchange rate system.

Mohtadi (1988) studied the movements in the EER indices of five African less developed countries that choose to peg to the U.S. dollar. He considered minimizing the variance of the real EER. He found that those five countries could have decreased the instability in their real EER had they pegged their currencies to the SDR instead. His recommendation was to peg to a basket of currencies that reflects the country's trade pattern, an example of which is the SDR.

Determinants of International Trade Flows

Most of the empirical studies of international trade flows have, in general, focused on the formulation and estimation of demand relationships for imports and exports. For example, studies of the demand for imports have generally employed the conventional form of the estimating equation. This form relates the quantity of import demanded by a country to the ratio of import prices to domestic prices (assuming a degree of substitutability between imports and domestic goods) and to domestic real income. On the export side, it relates the world demand of a country's exports to the ratio of export prices to world prices and to world real income. The studies by Turnovsky (1968), Houthakkar and Magee (1969), Khan (1974, 1975), Khan and Ross (1975), and Goldstein and Khan (1976, 1978) are examples.

Turnovsky (1968) conducted a study estimating annual aggregate import and export functions for New Zealand over the post-war period (1947-63) and used these equations to derive estimates of various demand elasticities.

In another study, Houthakker and Magee (1969) estimated demand elasticities for both imports and exports with respect to income and price for a number of countries, most of them developed. They used an annual observations covering the period 1951-1966. This study investigated total imports and exports by country. In addition, it provided more detailed studies of the United States trade by country of origin or destination, and by commodity class.

Khan (1974) extended the study of Houthakker and Magee (1969) to provide comprehensive coverage of developing countries. His aim was to

provide estimates of import and export demand functions for fifteen developing countries. He also tested the hypothesis of whether changes in prices of traded and nontraded goods have any significant impact on the trade flows of these countries.

Khan (1974), also, used the simple formulation of aggregate import and export demand equations mentioned earlier. His study covered the period 1951-69, which is almost the same period covered by Houthakker and Magee (1969). He concluded that prices do play an important role in the determination of imports and exports of developing countries. The size of the estimated price elasticities was fairly high for most of the fifteen countries studied which guarantees the Marshall-Lerner condition for successful devaluation. The same conclusion was reached by Houthakker and Magee (1969) for industrial counties.

Khan (1975) studied the behavior of the imports of Venezuela at both the aggregate and disaggregate (by commodity) levels for the period 1953-1972. His conclusion was that simple specifications (both at the aggregated as well as disaggregated levels) including only real income and relative prices as explanatory variables were good enough to explain a large proportion of the variation in Venezuelan imports.

Goldstein and Khan's (1976) purpose was to estimate import demand functions for twelve industrial countries and test the proposition that the import price elasticity is a function of the size of the relative price change. They utilized quarterly data to cover the period 1955-1973. Their model was similar to those used in the earlier studies. They concluded that, for eight of the twelve countries in their sample, import demand was responsive to relative

prices. Furthermore, their empirical results do not support the hypothesis that import demand will respond nonproportionately due to the size of the relative price change.

Another type of study of international trade flows used the traditional approach with one significant difference. Since most of these studies were conducted with the purpose of assessing the effect of exchange rate on trade flows, an exchange rate variable was added to the right hand side of both export and import equations (see for example, Wilson and Takacs (1979), Gafar (1981), Warner and Kreinin (1983), Bahmani-Oskooee (1984, 1986), Batten and Belongia (1984, 1987), Belongia (1986), Ott (1987), Thursby and Thursby (1987) and Salehi-Isfahani (1989)).

A number of justifications have been given for the change in the traditional, formulation of export and import equations. For instance, Bahmani-Oskooee (1984) argues that this issue arises from the fact that most developing countries peg their currencies to a single major currency or a basket of currencies. However, under the generalized floating exchange rate system, the major currencies in the world fluctuate against one another. This may cause the effective exchange rate facing developing countries to fluctuate affecting trade flows.

This specification, according to Warner and Kreinin (1983), divides the effect of changes in the real exchange rate on trade flows into two parts; nominal exchange rate and price components. Furthermore, they argue that the rationale for expecting a different response, on the part of traders, to changes in the exchange rate and changes in other foreign prices is:

"the visibility of exchange rate movements; market participants may be more aware of them than they are of other price changes. Secondly, there are fewer errors in measurement of exchange rate changes than of other price changes. And finally, traders may perceive one type of changes as more transitory and/or reversible than another, including a different kind of response."

Using quarterly import and export equations for six major industrial countries during the Bretton Woods period, Wilson and Takacs (1979) estimated directly the price and exchange rate response pattern. They used a conventional trade flow model which includes both relative prices and real income variables. They reached the general conclusion that imports and exports react quicker and total response time was shorter when exchange rates, rather than export price in domestic currency, caused a change in international prices.

In a more comprehensive study, Warner and Kreinin (1983) constructed a model to estimate import and export demand functions for nineteen industrial countries. Their study covers both the period of generalized floating (1972-1980) and the period of fixed exchange rates (1957-1970). Besides the traditional income and price variables, this study investigated the impact of variations in the exchange rate and in the expected exchange rate on real trade flows. For that reason, they modified their equations to account for estimating, separately, the effect of exchange rate variations on the volume of imports and exports. Accordingly, the import price, for example, was expressed in terms of foreign currencies (PM^{FC}), with an expected negative

sign, and an explicit exchange rate variable (E) was added, with an expected positive sign[19]

Warner and Kreinin (1983) reached some interesting conclusions regarding the specification of the trade flows. First of all, their empirical results suggest that separating relative price variables into their components provides more accurate results. Secondly, the volume of imports in several major countries has been affected significantly due to the switch from fixed to floating exchange rates. Finally, the exchange rate and export price of competing countries appear to be significant determinant of a country's exports.

In a similar study, Bahmani-Oskooee (1984) studied the effect of effective exchange rates on trade flows. He provides estimates of imports and exports demand functions in which the effective exchange rate is included as another determinant of trade flows. He estimated these functions for three countries; Korea, South Africa and Thailand. He argues that while some developing countries peg their currencies to a major currency, they should not be considered as if they were on a fixed exchange rate system. The reason for this, is the fluctuations among major currencies which imply fluctuations in the effective exchange rates of the developing countries which will affect trade flows. He found the size of elasticities of effective exchange rate to be small which suggests that devaluation or a more flexible rate system will not solve the problem of the trade deficit. With the size of price elasticities being fairly low for all three countries studied, Bahmani confirmed the common view that developing countries have a price inelastic demand for import and export goods.

---

[19] The reason is that they define E as units of foreign currency per unit of domestic currency.

Batten and Belongia (1984) studied the decline in U.S. agricultural exports during the 1982-83 and raised the question whether the exchange rate was responsible. They estimated the effects of real changes in exchange rates on export volume by employing a simple econometric model of the determinants of world trade. Focusing on factors affecting the volume of U.S. agricultural exports, their empirical results indicated that real exchange rates were negatively related to exports. At the same time, the level of real GNP in importing countries has a dominating impact.

Although there is wide agreement on the qualitative aspects of the effect of exchange rate changes on U.S. exports, there are considerable controversies about the actual magnitude and persistence of these effects[20] Belongia (1986) believes that using different exchange rate indexes may be one source of this disagreement. Using U.S. agricultural exports as an example and employing the same model used by Batten and Belongia (1984), he domestrated that different exchange rate measures can yield substantially different conclusions about the U.S. competitive position in world markets, and the estimated effects of changes in the dollar's value on exports and the relationship between the exchange rate and other economic variables. Furthermore, he emphasized the importance of countries included in the index and the weighting scheme used to aggregate movements in foreign currency values in interpreting the results.

In another study, Bahmani-Oskooee (1986) provides new estimates of aggregate import and export demand functions for seven developing countries. He used quarterly data for the period 1973-1980. His conclusion

---

[20] Belongia (1986), p.t.

was similar to those of his previous study. He also estimated directly price and exchange-rate response patterns for the same seven countries. He found that trade flows were quicker and the total response time was shorter when an exchange rate, rather than relative prices measured in domestic currency, caused a change in international prices[21]. In the long run, he reached the conclusion that trade flows are more responsive to changes in the relative prices than to changes in the exchange rates.

Some insights about the relative importance of the choice of weights for constructing the effective exchange rate were provided by Ott (1987) who examined the effect of changing the weights for a given set of exchange rates. In particular, he studied the impact of alternative weighting schemes for the dollar's effective exchange rate. Those weighted effective exchange rates were compared in terms of their explanatory power and out-of-sample forecasts in a trade equation.

Ott (1987) concluded that the weighted effective exchange rates studied were highly correlated. He also concluded that their explanatory and predictive power were statistically equivalent in an agriculture export equation.

Batten and Belongia (1987) focused on the issue of the range of currencies that should be included in an effective exchange rate index. In this study, they compared the new exchange rate indexes which contain a broader range of currencies with the old exchange rate indexes which contain less currencies in terms of reflecting the movements in the dollar more accurately, and hence, explaining U.S. trade flows.

---

[21] This conclusion is in agreement with that of Wilson and Takacs (1979) as far as the experience of industrial countries was concerned.

A model for U.S. merchandise exports and U.S. non-petroleum imports was constructed to examine whether the new indexes are more closely related to trade flows than the more traditional exchange rate measures. The real exchange rate was included directly to measure U.S. prices relative to those in the rest of the world (expressed in dollars), taking into account price-level differences across countries. Batten and Belongia reached the conclusion that the new broader indexes performed no better than the old indexes. In fact, they performed worse than the existing, more narrowly based exchange rate indexes.

CHAPTER IV

METHODOLOGY AND EMPIRICAL RESULTS

A Simple Model of Saudi Arabian Foreign Trade

As mentioned in Chapter I, the purpose of this study is twofold. First, to provide new estimates of both aggregate and disaggregate import and export demand equations for Saudi Arabia, using annual data on the relevant variables for the period 1973-1986. Second, to investigate and determine empirically the optimum currency peg for the Saudi riyal.

In this section, the suggested models (aggregate and disaggregate) are, briefly, described. Both use the conventional formulations of trade flows (exports and imports demand) functions developed in the literature of international trade. Thus, these models include variables found in many other studies of imports and exports. These models will be estimated in the familiar functional form.

The approach employed in this study relies on the reduced form of the world demand for Saudi Arabian exports and Saudi import demand functions to derive the effects of different exchange rate regimes on the trade balance. By influencing domestic relative prices, a specific type of currency peg exerts real effects on import demand and world demand for exports.

Aggregate Model

Aggregate Export Demand Function. Studies of the world demand for a country's exports have employed a conventional form of demand equation. In its simplest formulation, it assumes that the world demand for a country's exports to depend on two factors: the level of foreign real economic activity and the price of this country's exports relative to those of other countries. Applying this formulation to the case of Saudi Arabia, the world demand for Saudi Arabian aggregate exports can be specified in the following form:

$$X^d = f\left(\frac{P_x}{P_w}, Y_w\right) \qquad \text{.....(1)}$$

where X^d is the quantity of Saudi Arabian exports demanded by the rest of the world, P_x is the Saudi export price in domestic currency, P_w is the world price level in domestic currency and Yw is real world income.

Since my objective is to assess the relative impact of different exchange rate regimes on trade flows, equation (1) is modified to include the exchange rate term explicitly. According to the Purchasing Power Parity (PPP)[1], P_x can be defined as:

$$P_x = E * P_{xw} \qquad \text{.....(2)}$$

where E is exchange rate defined as units of foreign currency per unit of domestic currency and P_{xw} is the price of exports in foreign currency. Substitute (2) into (1) to get:

---

[1] This theory implies that the equilibrium exchange rate between two currencies occurs when they have equivalent domestic purchasing power. For instance, if 1 U.s. dollar currently exchanges for 3.75 Saudi riyals, then PPP exists if those money amounts can buy the same basket of goods in their particular countries.

$$X^d = f\left(\frac{E^* P_{xw}}{P_w}\ ,\ Y_w\right) \qquad \text{.....(3)}$$

or alternatively, expressing the exchange rate term as a separate explanatory variable, equation (3) can be restated as:

$$X^d = f\left(\frac{P_{xw}}{P_w}\ ,\ Y_w\ ,\ E\right) \qquad \text{.....(4)}$$

Warner and Kreinin (1983) argue that this specification splits the effect of changes on the real exchange rate on trade flows into the nominal exchange rate and price components.

In log-linear form and introducing a stochastic element, the estimating equation of the world demand for the Saudi exports is:

$$\log X_t^d = \alpha_o + \alpha_1 \log\left(\frac{P_{xw}}{P_w}\right)_t + \alpha_2 \log Y_{wt} + \alpha_3 \log E_t + U_t \qquad \text{.....(5)}$$

where X_d, P_{xw}, P_w, Y_w and E have been previously defined, t represents time and U is an error term with the following properties:

$$E(U) = 0\ ;\ E(UU') = \sigma^2 I$$

Since equation (5) is specified in logarithms, α_1 and α_2 are the relative price and income elasticities of export demand, respectively. Their expected signs are negative and positive ($\alpha_1 < 0\ ;\ \alpha_2 > 0$). Defining the exchange rate as units of foreign currency per unit of domestic currency, α_3 is expected to have a negative sign ($\alpha_3 < 0$); a depreciation of domestic currency stimulates exports if the Marshall-Lerner condition is satisfied. Equation (5) yields estimated coefficients that are partial elasticities.

Aggregate Import Demand Function. The simplest formulation of an aggregate import demand equation assumes the quantity of imports demanded by a country is a function of the ratio of imports prices to domestic prices and to domestic real income. Applying this formulation to the case of Saudi Arabia, we can specify the aggregate Saudi imports demand in the following mathematical form:

$$M^d = f\left(\frac{P_m}{P_d}, Y_d\right) \qquad \text{.....(6)}$$

where M^d is the quantity demanded of Saudi imports, P_m is the Saudi import price in domestic currency, P_d is the domestic price level in domestic currency and Y_d is domestic real income.

In order to introduce the exchange rate explicitly I used the PPP condition:

$$P_m = E * P_{mw} \qquad \text{.....(7)}$$

where Pmw is the price of imports in foreign currency. Substitute (7) into (6) to get:

$$M^d = f\left(\frac{E * P_{mw}}{P_d}, Y_d\right) \qquad \text{.....(8)}$$

or alternatively, expressing the exchange rate term as a separate explanatory variable, equation (8) can be restated as:

$$M^d = f\left(\frac{P_{mw}}{P_d}, Y_d, E\right) \qquad \text{.....(9)}$$

In log-linear terms, the estimating equation of the Saudi import demand has the following form:

$$\log M_t^d = \beta_o + \beta_1 \log \left(\frac{P_{mw}}{P_d} \right)_t + \beta_2 \log Y_{dt} + \beta_3 \log E_t + V_t \quad \text{.....(10)}$$

where M^d, P_{mw}, P_d, Y_d and E have been previously defined, t represents time and V is a standard normal error term.

In (10), β1 and β2 are the relative price and income elasticities of import demand, respectively. Their expected signs are negative and positive ($\beta_1 < 0$; $\beta_2 > 0$)[2]. Defining the exchange rate as above, β_3 is expected to have a positive sign ($\beta_3 > 0$); an appreciation of domestic currency stimulates imports.

Effective Exchange Rate Calculation. The exchange rate E is defined in effective terms. It can be calculated in one of the following two ways:

1. Arithmetic mean:

$$E_t = \sum_{i=1}^{n} (W_i * E_{it}) \quad \text{.....(11)}$$

2. Geometric mean:

$$E_t = \prod_{i=1}^{n} (E_{it})^{W_i} \quad \text{.....(12)}$$

where i=1, . . ., n ; and

n = number of trading partners.

E_t = the value of effective exchange rate index at time t, relative to a base period value of the index.

---

[2]Khan and Ross (1975) argues that the sign of β_2 is ambiguous. They based their argument on the definition of imports as the difference between consumption of importables and the production of importables When real income rises, it is not clear whether consumption of importables will rise faster or slower than production. Thus, imports could easily rise or fall.

E_{it} = bilateral exchange rates in units of country i's currency per unit of the domestic currency at time t.

W_i = weight of country i's currency.

Arithmetic averaging may yield an upward bias to the measurement of changes in the domestic currency's average exchange value. The reason, as explained by Belongia (1986), is that as currencies diverge from each other over time, changes in currencies that rose against the domestic currency (the U.S. dollar in this case) had a reduced impact on the index while change in currencies that fell against the domestic currency had an increased impact on the index. As a result, arithmetic averaging will yield an upward bias in the measurement of changes in the domestic currency's average exchange value[3]. In this study, I will use both effective exchange rate measures.

Effective Exchange Rate Weighting Schemes. Most studies in this area employ one or more of the following weighting schemes:

A. Import Weights:

$$W_i = \frac{M_i}{M} \qquad \text{.....(13)}$$

where M_i is imports from country i and M is total imports.

B. Export Weights:

$$W_i = \frac{X_i}{X} \qquad \text{.....(14)}$$

where X_i is exports to country i and X is total exports.

---

[3] For further clarification and an example, see Belongia (1986), P.7.

C. Trade Weights:

$$W_i = \frac{X_i + M_i}{X + M} \qquad \text{.....(15)}$$

D. Special Drawing Right (SDR) Weights:

Here the weights assigned for each country's currency included in the SDR by International Monetary Fund (IMF) will be used. These weight are as follows:

United States	42%
West Germany	19%
Japan	13%
France	13%
United Kingdom	13%

A comparison of the composition of the SDR from 1974 to the present is shown in Table 3.1.

Since the five major countries whose currencies currently compose the SDR basket represent a large percentage of the foreign trade of the Saudi economy, this study will be limited to these five countries.

If we choose to peg to a single currency, we need to take an account of changes in, only, four currencies instead of five. Thus, E_i is constant for the currency peg country. But if we choose to peg to a basket of currencies, we have to take an account of changes in all the five currencies, simultaneously.

Disaggregate Model

In the area of international trade, the empirical literature on the determinants of bilateral trade flows has largely focused on explaining imports

and exports disaggregated by countries and, accordingly, on the trading patterns of industrial countries Due to the lack of relevant data, especially in the area of prices of disaggregated imports and exports, there have been very few studies designed to investigate imports and exports disaggregated by countries for developing countries In this section, we employ a model proposed by Thursby and Thursby (1987) to study the pattern of Saudi exports and imports at the bilateral level

Disaggregate Export Demand Function The underlying model will explain the pattern of aggregate exports from Saudi Arabia to the five countries mentioned previously The reduced form of country i's demand for the Saudi exports can be specified in the following mathematical form

$$RX_{it} = f(RGDP_t, RGNP_{it}, Pxw_t, Pmw_{it}, A_{it}) \qquad (16)$$

where RX_{it} is real Saudi exports to country i, $RGDP_t$ is Saudi real Gross Domestic Product, $RGNP_{it}$ is real Gross National product of country i, Pxw_t is the Saudi export price, Pmw_{it} is country i's import price, A_{it} is the bilateral exchange rate between the riyal and country i's currency defined as the number of currency i units per one riyal, and t represents time[4]

---

[4] The original reduced form equations, derived by Thursby and Thursby (1987) were for the quantity of exports from country i to country j (Q^i_j) and exports price of country i's exports to country j (P^i_j) Since data for these two terms are not generally available and data for their product $PQ^i_j = P^i_j Q^i_j$ is easily obtained, they estimated the equation

$$\ln(PQ^i_{jt}) = \ln(P^i_{jt}) + \ln(Q^i_{jt})$$

Among others, PD^o_j which is an index of import prices of exports of other countries and PS^i_o which is an index of net export prices of i's exports to other countries were explanatory variables of PQ^i_j As a measure of PD^o_j they use country j's unit value of imports (Pmw_i in equation (16)) and for PS^i_o they use country i's unit value of exports (Pxw in equation (16))

They argue that if these import and export price indices are calculated in a similar way across countries, they will be reasonable approximations of indices computed from import and export price data for bilateral trade

Expressed in a log-linear terms, the estimating equation will take the following form

$$\log RX_{it} = \gamma_0 + \gamma_1 \log RGDP_t + \gamma_2 \log RGNP_{it} + \gamma_3 \log Pxw_t + \gamma_4 \log Pmw_{it} + \gamma_5 \log A_{it} + \varepsilon_{it} \quad (17)$$

where ε_{it} are error terms assumed to be normal and independent, with zero means and constant variances

For example, γ_5 measures the percentage change of the real U S demand (if i is the U S) for Saudi exports resulting from a one percent change in the bilateral exchange rate between the riyal and the dollar The sign of these coefficients are expected to be as follows

$$\gamma_1, \gamma_3, \text{and } \gamma_4 \gtrless 0 \ , \ \gamma_2 > 0 \ , \ \gamma_5 < 0$$

i e the value of exports (denominated in riyals) will decrease in response to an appreciation of the riyal vis-a-vis the i country's currency The reason for this ambiquity in γ_1 and γ_3 is because equation (17) is a reduced form equation for the value of exports Without the bilateral prices and quantities the structural parameters of the model cannot be estimated While this does not lead to any statistical bias for the estimates of equation (17), it leads to possible ambiquity in interpreting coefficients of any variables included only in the simple equation (RGDP and Pxw) The expected sign for γ_4 is ambiquous depending on the substitutibility among goods [5]

Disaggregate Import Demand Function The model explains the pattern of Saudi aggregate imports demand from the same five countries The

[5]Thursby and Thursby (1987)

reduced form of Saudi import demand from country i can be specified in the following form

$$RM_{it} = f (RGDP_t , RGNP_{it} , Pmw_t , Pxw_{it} , A_{it}) \quad (18)$$

where RM_{it} is real Saudi imports from country i, $RGDP_t$, $RGNP_{it}$, and A_{it} have been previously defined, Pmw_t is the Saudi import price and Pxw_{it} is counrtry i's export price

Expressed in a log-linear terms, the estimating equation will take the following form

$$\log RM_{it} = \delta_0 + \delta_1 \log RGDP_t + \delta_2 \log RGNP_{it} + \delta_3 \log Pmw_t + \delta_4 \log Pxw_{it} + \delta_5 \log A_{it} + \eta_{it} \quad (19)$$

where η_{it} are error terms assumed to be normal and independent, with zero means and constant variances

The sign of these coefficients are expected to be as follows

$$\delta_1 > 0 \ , \ \delta_2, \ \delta_3, \text{ and } \delta_4 \ \gtrless 0 \ , \ \delta_5 > 0$$

i e the value of imports (denominated in riyals) will increase in response to an appreciation of the riyal vis-a-vis the i country's currency The reason for this ambiguity in δ_2 and δ_4 is because equation (19) is a reduced form equation for the value of imports Without the bilateral prices and quantities the structural parameters of the model cannot be estimated While this does not lead to any statistical bias for the estimates of equation (19), it leads to possible ambiquity in interpreting coefficients of any variables included only in

the supply equation (RGNPi and Pxwi) The expected sign for δ_3 is ambiguous depending on the substitutability among goods [6]

Data Sources

In this study, I use annual data for the period 1973 - 1986 The beginning point, 1973 is chosen because it marks the beginning of generalized floating The year 1986 is the latest year for which data are available This study concentrates on the period following the breakdown of the Bretton Woods system The sources of data are as follows

1 International Monetary Fund, International Financial Statistics, various issues Data for the following variables was obtained

M = the value of Saudi imports

X = the value of Saudi exports

CPI = the Saudi consumer price index

GDP = the Saudi Gross Domestic Product

Pxw_i = export unit value index of country i (i = 1, , 5 as before)

Pmw_i = import unit value index of country i (i = 1, , 5 as before)

E_i = bilateral exchange rate between the riyal and currency i

Pwoil = world exort unit value index for oil

Pw = world export unit value index

2 International Monetary Fund, Supplement on Trade Statistics, Supplement Series, No 15, 1988

Pxw = exort unit value index of Saudi Arabia

[6]Thursby and Thursby (1987)

Pmw = import unit value index of Saudi Arabia

Yw = world nominal income (GDP)

3 International Monetary Fund, Balance of Payments Statistics, various issues The bilateral exchange rate between the riyal and the SDR was obtained from this source

4 Saudi Arabian Monetary Agency (SAMA), Annual Report, various issues The bilateral exports and imports were taken from this source

Empirical Results

In this section, the empirical results of the models presented in the previous section will be reported and discussed In particular, I estimated equations (5) and (10) for the aggregate model and equations (17) and (19) for the disaggregate model Those equations were estimated using the method of ordinary least squares (OLS)

Aggregate Model

Aggregate Import Demand Function Tables 4 1 and 4 2 contain the regression results of the aggregate imports demand functions using different effective exchange rate indexes They show the OLS estimated coefficients and their t-ratios (in parantheses), the adjusted coefficients of determination $\bar{R}^2$ and the Durbin-Watson statistics (DW) for the different estimated equations

For convenience, the symbols $EERI_m$, $EERI_x$, $EERI_t$ and $EERI_{sdr}$ in Tables 4 1 and 4 2 refer to the effective exchange rate weighted by imports, exports, total trade and the SDR weights, respectively Moreover, LRP_{mc}, LRGDP and

TABLE 4 1

ESTIMATES OF SAUDI ARABIAN AGGREGATE IMPORT EQUATIONS
(ARITHMETIC MEANS)

Exchange Rate Index	Intercept	LRPMC	LRGDP	LE_I	$\bar{R}^2$	DW
$EERI_m$	-8 907* (-2 70)	-1 860** (-4 40)	3 235** (10 43)	0 603 (1 64)	0 92	1 34
$EERI_x$	-8 679* (-2 57)	-1 442** (-3 24)	3 068** (11 00)	0 337 (1 49)	0 92	1 15
$EERI_t$	-9 015* (-2 29)	-1 493** (-3 29)	3 153** (10 01)	0 359 (1 23)	0 91	1 24
$EERI_{sdr}$	-7 774* (-1 77)	-1 636** (-3 61)	3 006** (10 11)	0 418 (0 69)	0 91	1 27

Note t-ratios are in parentheses EERIm, EERIx, EERIt and EERIsdr are the effective exchange rate weighted by imports, exports, total trade and the SDR weights, respectively

* Significant at the 0 05 level

** Significant at the 0 01 level

TABLE 4 2

ESTIMATES OF SAUDI ARABIAN AGGREGATE IMPORT EQUATIONS
(GEOMETRIC MEANS)

Exchange Rate Index	Intercept	LRPMC	LRGDP	LE_l	$\bar{R}^2$	DW
$EERI_m$	-5 586* (-2 27)	-2 030** (-4 63)	2 844** (10 60)	0 539* (1 87)	0 93	1 10
$EERI_x$	-6 682* (-2 42)	-1 490** (-3 37)	2 920** (10 50)	0 136 (1 38)	0 92	1 04
$EERI_t$	-6 977* (-2 20)	-1 545** (-3 35)	3 000** (10 38)	0 160 (0 95)	0 91	1 56
$EERI_{sdr}$	-6 491* (-2 07)	-1 674** (-3 74)	2 776** (6 95)	0 462 (0 73)	0 91	1 14

Note See note to Table 4 1

LE_I refer to the log of ithe relative price of imports, the log of Saudi real GDP and the log of the EERI (i = m, x, t and sdr), respectively The Durbin-Watson (DW) will be used to test for the presence of serial correlation The EERI (E_I) required to estimate this equation was calculated according to the arithmetic means for Table 4 1 and the geometric means for Table 4 2

Since one of my objectives in this study is to assess the relative impact of different types of exchange rate regimes on the Saudi imports demand and the demand for Saudi exports, the coefficient of E_I is of particular interest

In Tables 4 1 and 4 2, eight different estimated equations of Saudi aggregate imports demand functions are presented Comparing the different equations of those two tables, some observations can be drawn All the estimated coefficients for the independent variables have their expected sign and are, in general, significantly different from zero at the 5 percent significance level in all the eight equations

In the first equation in Table 4 2, which was estimated with $EERI_m$ (effective exchange rate index calculated using geometric means formula and weighted by import shares), all the explanatory variables have their a priori signs and are significantly different from zero at the 5 percent significance level Consequently, that equation is selected to represent the Saudi aggregate imports demand function for the period covered in this study (1973-1986)

In some equations there was evidence of first-order autocorrelation in the error term V_t of equation (10), as indicated by the value of the DW statistics To

correct for this problem, the corresponding equations were re-estimated assuming that the error terms follow a first-order autoregressive process

$$V_t = \rho_1 V_{t-1} + e_{t1}$$

where ρ_1 is the coefficient of autocorrelation, $|\rho_1| < 1$, and e_{t1} is an error term which is independently normally distributed

Tables 4 3 and 4 4 presents the estimated equations corrected for autocorrelation However, in only two of the eight equations the first order autocorrelation appeared significantly different from zero Thus the equation mentioned previously is the one to be considered here to represent the import demand side The relative price elasticity term has the expected negative sign (-2 03) and is significantly different from zero at the one percent significance level This means that an increase in relative prices by one percent will generate a decrease in imports by 2 03 percent It is, therefore, concluded that relative prices have a significant effect on the aggregate import demand of Saudi Arabia

Real GDP elasticity also has the expected positive sign (2 84) and is significantly different from zero at the one percent significance level This implies that an increase in real GDP by one percent will cause an increase in imports by 2 84 percent As far as the exchange rate variable in concerned, its elasticity also has the expected positive sign (0 54) and is significantly different from zero at the 5 percent significance level This suggests that an appreciation of the riyal by one percent will generate an increase in imports of 0 54 percent

TABLE 4.3

ESTIMATES OF SAUDI ARABIAN AGGREGATE IMPORT EQUATIONS
CORRECTED FOR AUTOCORRELATION
(ARITHMETIC MEANS)

Exchange Rate Index	Intercept	LRPMC	LRGDP	LE_i	ρ	$\bar{R}^2$	DW
$EERI_m$	-10.612* (-2.57)	-2.308** (-2.97)	3.668** (7.88)	0.855* (2.24)	0.138 (0.29)	.91	1.53
$EERI_x$	-9.195 (-1.55)	-1.694 (-1.71)	3.240** (5.79)	0.461 (1.65)	0.347 (0.58)	.90	1.34
$EERI_t$	-10.250 (-1.66)	-1.770 (-1.70)	3.448** (6.40)	0.511 (1.51)	0.234 (0.37)	.89	1.46
$EERI_{sdr}$	-7.632 (-1.03)	-1.918* (-2.02)	3.070** (5.63)	0.570 (0.74)	0.276 (0.44)	.87	1.31

Note: See note to Table 4.1.

TABLE 4.4

ESTIMATES OF SAUDI ARABIAN AGGREGATE IMPORT EQUATIONS
CORRECTED FOR AUTOCORRELATION
(GEOMETRIC MEANS)

Exchange Rate Index	Intercept	LRPMC	LRGDP	LE_i	ρ	$\bar{R}^2$	DW
$EERI_m$	-5.340 (-1.51)	-2.527** (-3.57)	3.023** (6.23)	0.732* (2.17)	0.339 (0.74)	.92	1.21
$EERI_x$	2.155 (0.27)	-1.388* (-2.18)	1.385 (1.24)	0.102 (0.64)	0.842** (5.07)	.91	0.71
$EERI_t$	-6.773 (-0.98)	-1.817 (-1.58)	3.084** (4.89)	0.256 (1.04)	0.381 (0.54)	.88	1.26
$EERI_{sdr}$	4.082 (0.51)	-1.424* (-2.14)	0.894 (1.05)	0.364 (0.32)	0.838** (5.43)	.91	0.56

Note: See note to Table 4.1.

From the previous discussion, it is obvious that the real GDP has the greatest impact on imports demand relative to the other independent variables included in this equation. The same conclusion was reached by Hafiz (1981) using the non-oil GDP instead of the whole GDP.

There are some noticeable differences in the magnitude of the response of the Saudi aggregate imports to changes in the value of the riyal. In Tables 4.1 and 4.2, the response, measured by the estimated exchange rate elasticity, varies from 0.136 for the geometric $EERI_x$ to 0.603 to the arithmetic $EERI_m$. Clearly, the estimated response of Saudi aggregate imports to changes in the value of the riyal is sensitive to both the type of formula (arithmetic or geometric means) and the type of weight (imports, exports, total trade or SDR weights) used for computing the EERI.

The high income elasticity should be considered very carefully. This is because it might have an adverse impact on the trade balance. If, for example, a country and its trade partners are growing at the same rate (and assuming prices to be constant), and this country has a higher income elasticity than its partners, then this country will experience a more rapid growth in imports relative to its exports. Consequently, this will result in a trade deficit in this country[7] .

Aggregate Export Demand Function. Tables 4.5 and 4.6 show the regression results of the world demand for Saudi exports using the different effective exchange rates mentioned earlier. For convenience, the symbols LRP_x, $LRY_w(-1)$ and LE_i refer to the log of exports relative prices, the log of the real foreign income lagged one year and the log of the EERI, respectively.

---

[7] Gafar (1981), P. 159.

TABLE 4 5

ESTIMATES OF SAUDI ARABIAN AGGREGATE EXPORT EQUATIONS
(ARITHMETIC MEANS)

Exchange Rate Index	Intercept	LRP_x	$LRY_w^{(-1)}$	LE_i	$\bar{R}^2$	DW
$EERI_m$	-18 427** (-7 54)	-1 115* (-2 59)	2 968** (11 24)	-0 368 (-1 47)	0 91	1 27
$EERI_x$	-17 552** (-5 42)	-1 288* (-1 89)	2 842** (6 76)	-0 096 (-0 37)	0 89	1 21
$EERI_t$	-18 137** (-6 59)	-1 428* (-2 50)	2 934** (9 25)	-0 040 (-0 17)	0 89	1 25
$EERI_{sdr}$	-17 718** (-5 34)	-1 420** (-2 91)	2 927** (9 43)	-0 124 (-0 26)	0 89	1 33

Note See note to Table 4 1

TABLE 4 6

ESTIMATES OF SAUDI ARABIAN AGGREGATE EXPORT EQUATIONS
(GEOMETRIC MEANS)

Exchange Rate Index	Intercept	LRP_x	LRYW(-1)	LE_l	$\bar{R}^2$	DW
$EERI_m$	-13 679** (-6 21)	-0 937** (-3 14)	2 501** (10 77)	-0 523** (-3 47)	0 95	2 26
$EERI_x$	-13 291** (-2 83)	-0 599 (-0 74)	2 181** (3 20)	-0 199 (-1 24)	0 91	1 16
$EERI_t$	-16 928** (-5 15)	-1 183* (-1 95)	2 746** (6 45)	-0 116 (-0 66)	0 90	1 17
$EERI_{sdr}$	-11 238* (-1 81)	-1 232** (-2 97)	2 452** (5 00)	-0 632 (-1 23)	0 91	1 79

Note See note to Table 4 1

In Tables 4.5 and 4.6, eight differnent estimated equations of the world demand for Saudi exports are presetned. Comparing the different equation, some observations can be mentioned. All the estimated coefficients for the independent variables have the expected signs and are, in general, significantly different from zero at the 5 percent significance level in all the eight equations.

In the first equation of Table 4.6, which was estimated with EERIm (effective rate index calculated using geometric means formula and weighted by import shares), all the explanatory variables having their a priori expected sign and are significantly different from zero at the 5 percent significance level. This equation also has a high DW indicating the absence of autocorrelation. Consequently, that equation is selected to represent the world demand for Saudi exports function for the period covered in this study (1973-1986).

In some equations there was evidence of first-order autocorrelation in the error term Ut of equation (5). Tables 4.7 and 4.8 presents the estimated equations corrected for autocorrelation. However, the new estimated equations do not appear to enhance the results of the world demand for Saudi exports and are, therefore, not considered further.

The relative price elasticity in the chosen equation has the expected negative sign (-0.94) and is significantly different from zero at the one percent significance level. This implies that an increase in the relative prices by one percent will cause a deterioration in the world demand for Saudi exports by 0.94 percent.

TABLE 4.7

ESTIMATES OF SAUDI ARABIAN AGGREGATE EXPORT EQUATIONS
CORRECTED FOR AUTOCORRELATION
(ARITHMETIC MEANS)

Exchange Rate Index	Intercept	LRP_x	$LRY_w(-1)$	LE_i	ρ	$\bar{R}^2$	DW
$EERI_m$	-15.965**	-0.461	2.678**	-0.915	0.462	.92	2.16
	(-4.29)	(-0 70)	(6.70)	(-1.74)	(0.14)		
$EERI_x$	-15.398**	-1.007	2.568**	-0.221	0.477	.89	1.72
	(-3.06)	(-1.37)	(4.39)	(-0.70)	(1.25)		
$EERI_t$	-16.622**	-1.173	2.734**	-0.170	0.464	.89	1.74
	(-3.48)	(-1.76)	(5.23)	(-0.50)	(1.18)		
$EERI_{sdr}$	-18.326**	-1.573*	2.910**	0.195	0.417	.89	1.73
	(-3.54)	(-2.66)	(5.72)	(0.21)	(0.75)		

Note: See note to Table 4.1.

TABLE 4.8

ESTIMATES OF SAUDI ARABIAN AGGREGATE EXPORT EQUATIONS
CORRECTED FOR AUTOCORRELATION
(GEOMETRIC MEANS)

Exchange Rate Index	Intercept	LRPx	LRYW(-1)	LE_i	ρ	$\bar{R}^2$	DW
$EERI_m$	-11.316**	-0.647*	2.224**	-0.705**	-0.266	.97	2.18
	(-5.85)	(-2.30)	(10.74)	(-5.29)	(-1.00)		
$EERI_x$	-12.191*	-0.572	2.073*	-0.218	0.434	.91	1.64
	(-2.17)	(0.67)	(2.72)	(-1.16)	(1.09)		
$EERI_t$	-14.862**	-0.978	2.490**	-0.189	0.482	.90	1.68
	(-3.04)	(-1.49)	(4.35)	(-0.86)	(1.20)		
$EERI_{sdr}$	-12.441	-1.297**	2.557**	-0.544	0.120	.89	1.90
	(-1.61)	(-2.76)	(4.23)	(-0.83)	(0.30)		

Note: See note to Table 4.1.

The world real GDP's elasticity also have the expected positive sign (2.50) and is significantly different from zero at the one percent significance level. This suggest that an increase in the lagged world real GDP by one percent will create an increase in exports by 2.50 percent.

Finally, the exchange rate elasticity also has the expected negative sign (-0.52) and is significantly different from zero at the 5 percent significance level. This means that a depreciation of the riyal by one percent will improve exports by 0.52 percent. This shows the relative importance of changes in the exchange rate of the riyal in determining the world's demand for Saudi exports.

Once again, the world real GDP is the dominant factor explaining export demand. This finding is, also, in agreement with that of Hafiz (1981).

In summary, and comparing the results provided in by import and export equations the Saudi income elasticity for imports is larger than the income elasticity of demand for its exports, $\beta_2 > \alpha_2$. This suggests that, other things equal, if the world real income and Saudi income increased at a uniform rate, the Saudi riyal would tend to depreciate. Furthermore, the results reported in these two equations indicate that changes in the riyal's value affect the Saudi trade balance. For the Saudi economy, the exchange rate has a more powerful effect on its imports demand than on the demand for its exports; $\beta_3 > \alpha_3$. This might be because exports denoiminated in U.S. dollars and, therefore, currency changes not expected to be significant. Finally, by looking to the values of price elasticities of imports and exports, the Marshall-Lerner condition for a successful devaluation is satisfied.

To determine the relative accuracy of the results and estimates of this study, they are compared with estimates from other studies. Tables 4.9 and 4.10 were constructed to summarize some of the previous studies conducted in the field. Table 4.9 provides a comparison of estimated elasticities of aggregate exports. This Table demonstrates how the estimates of this study are similar to those included. Furthermore, Table 4.10 shows a comparison of estimated elasticities of aggregate imports. Comparing the results of this study with those included in the two tables, it is concluded that the results of this study fall within the range of the results reported previously.

Disaggregate Model

In this part, I estimate the Saudi bilateral trade (imports and exports) with five major trade partners. The empirical results will be discussed in the following sub-sections.

Disaggregate Import Demand Functions. Equation (19) was estimated for Saudi import demand from the United States, Japan, West Germany, France and the United Kingdom. Tables 4.11-4.15 present the regression results for these estimated equations. They show the OLS estimated coefficients and their 5-ratios (in parantheses), the adjusted coefficients of determination $\bar{R}^2$ and the Durbin-Watson statistics (DW) for the different equations.

For convenience, the symbols LRGDP, LRGNPi, LPMW, LPXWi and LAi in Tables 4.11 - 4.15 refer to the log of Saudi real GDP, the log of real GNP of country i, the log of Saudi import unit value index, the log of country i's export unit value index and the log of the bilateral exchange rate between the riyal and the i currency, respectively.

In some cases, there was evidence of first-order autocorrelation in the error terms ηit of equation (19). The only clear evidence of significant

TABLE 4.9

A COMPARISON OF THE ESTIMATED ELASTICITIES
OF AGGREGATE EXPORTS

Study	Elasticities		
	Relative Price	Income	Exchange Rate
Hafiz (1981) Saudi Arabia	0.88	3.50	--
Bahmani-Oskooee (1984) 3 Deviloping countries	0.27 to -0.35	2.27 to -0.57	0.98 to -2.01
Bahmani-Oskooee (1986) 7 Deviloping countries	0.11 to -0.65	0.42 to -0.36	0.62 to -1.04
Almasbahi (1990) Saudi Arabia	-0.94	2.50	-0.52

TABLE 4.10

A COMPARISON OF THE ESTIMATED ELASTICITIES
OF AGGREGATE IMPORTS

Study	Elasticities		
	Relative Price	Income	Exchange Rate
Khan (1974) 15 Developing countries	-0.63 to -2.73	0.30 to 2.00	- -
Hafiz (1981) Saudi Arabia	-1.56	3.35	- -
Bahmani-Oskooee (1984) 3 Deviloping countries	0.36 to -0.65	0.41 to 1.71	0.18 5o -0.54
Bahmani-Oskooee (1986) 7 Deviloping countries	0.09 to -0.67	1.68 to -0.46	0.55 to -0.34
Almasbahi (1990) Saudi Arabia	-2.03	2.84	0.54

TABLE 4.11

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE
WITH THE UNITED STATES

	Intercept	LRGDP	$LRGNP_S$	LPMW	$LPXW_S$	LA_S
IMPORTS	-30.787**	4.726**	0.070**	-7.869**	2.693**	32.178**
	(-3.01)	(3.90)	(2.96)	(-4.16)	(2.93)	(4.33)
	$\bar{R}^2 = .93$		DW = 2.20			
	Intercept	LRGDP	$LRGNP_S$	LPXW	$LPMW_S$	LA_S
EXPORTS	11.200	4.558*	-0.005	-1.567*	-0.477	20.917*
	(0.59)	(2.21)	(-0.16)	(-2.00)	(-0.18)	(2.85)
	$\bar{R}^2 = .82$		DW = 1.68			

Note: t-ratios are in parentheses.
* Significant at the 0.05 level.
** Significant at the 0.01 level.

TABLE 4.12

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH JAPAN

	Intercept	LRGDP	$LRGNP_j$	LPMW	$LPXW_j$	LA_j
IMPORTS	-97.599**	3.858*	4.883*	2.568	-5.194	10.764*
	(-3.32)	(2.24)	(2.32)	(1.39)	(-1.71)	(2.55)
	$\bar{R}^2 = .88$		DW = 1.95			
	Intercept	LRGDP	$LRGNP_j$	LPXW	$LPMW_j$	LA_j
EXPORTS	44.210**	1.029*	-4.010**	-0.029	0.134	-4.395**
	(5.84)	(2.67)	(-9.22)	(-0.15)	(0.27)	(-4.78)
	$\bar{R}^2 = .93$		DW = 2.36			

Note: See note to Table 4.11.

TABLE 4.13

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH WEST GERMANY

	Intercept	LRGDP	$LRGNP_g$	LPMW	$LPXW_g$	LA_g
IMPORTS	-29.202 (-1.20)	3.132 (1.27)	2.653 (0.55)	4.262 (1.44)	-6.112 (-1.53)	6.675 (1.00)
	$\bar{R}^2 = .76$		DW = 1.39			
	Intercept	LRGDP	$LRGNP_g$	LPXW	$LPMW_g$	LA_g
EXPORTS	71.097* (2.91)	2.527 (1.40)	-12.622* (-2.66)	-0.350 (-0.56)	0.738 (0.21)	-15.947* (-2.44)
	$\bar{R}^2 = .72$		DW = 2.23			

Note: See note to Table 4.11.

TABLE 4.14

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH FRANCE

	Intercept	LRGDP	$LRGNP_f$	LPMW	$LPXW_f$	LA_f
IMPORTS	-163.113 (-1.73)	1.977 (0.33)	20.660 (1.35)	2.184 (0.33)	-5.808 (-0.74)	24.445 (1.23)
	$\bar{R}^2 = .61$		DW = 2.28			
	Intercept	LRGDP	$LRGNP_f$	LPXW	$LPMW_f$	LA_f
EXPORTS	21.100 (1.42)	3.642** (3.81)	-4.117 (-1.66)	0.496* (1.94)	-2.897* (-2.13)	-4.273 (-1.39)
	$\bar{R}^2 = .94$		DW = 2.58			

Note: See note to Table 4.11.

TABLE 4.15

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE
WITH THE UNITED KINGDOM

	Intercept	LRGDP	$LRGNP_k$	LPMW	$LPXW_k$	LA_k
IMPORTS	9.803 (0.52)	1.014 (0.50)	-5.003 (-1.40)	-0.679 (-0.22)	2.274 (0.79)	-5.665 (-1.05)
	$\bar{R}^2 = .80$		DW = 1.45			
	Intercept	LRGDP	$LRGNP_k$	LPXW	$LPMW_k$	LA_k
EXPORTS	32.958* (2.63)	0.101 (0.06)	-9.170** (-3.30)	-0.721* (-1.98)	2.099 (1.04)	-13.097** (-3.62)
	$\bar{R}^2 = .92$		DW = 2.80			

Note: See note to Table 4.11.

autocorrelation appears in the equations for the Saudi imports demand from West Germany and the United Kingdom. Tables 4.16 - 4.20 show the results for the equations corrected for first order autocorrelation. However, as shown in Tables 4.18 and 4.20, correcting for autocorrelation yields better results in the import demand from West Germany and the United Kingdom.

The exchange rate term, LAi, for import side has its expected positive sign for all the equations except the one for the United Kingdom.. However, it is significant at the 5 percent significance level for the equations of the United States in Table 4.11, Japan in Table 4.12 and West Germany in Table 4.18 and at the 10 percent significance level for the United Kingdomin Table 4.20. It is insignificant for France in Table 4.14.

The Saudi real GDP term has its expected positive sign in all the five equations. At the same time, it is only significant at the 5 percent significance level for the equations of the United States and Japan. This term turns out to be insignificant for the other three countries.

As for the exporting country's GNP term, it significant at the 5 percent significance level and with a positive sign for the United States and Japan and with a negative sign for the United Kingdomand West Germany. However, it does not exhibit any significant impact on the equation for France. The relative prices, LPMW and $LPXW_i$, are significant in all cases expcet the one for France.

Disaggregate Export Demand Functions. Equation (17) was estimated for the Saudi exports to the United States, Japan, West Germany, France and the United Kingdom. The lower half of Tables 4.11 - 4.15 present the regression results for these estimated equations.

TABLE 4.16

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH THE UNITED STATES (CORRECTED FOR AUTOCORRELATION)

	Intercept	LRGDP	$LRGNP_S$	LPMW	$LPXW_S$	LA_S	ρ
IMPORTS	-31.509*	4.695*	0.072*	-7.814**	2.693*	33.144**	-0.167
	(-2.43)	(2.41)	(2.69)	(-3.47)	(2.29)	(4.05)	(-0.29)
	$\bar{R}^2 = .89$		DW = 1.51				
	Intercept	LRGDP	$LRGNP_S$	LPXW	$LPMW_S$	LA_S	ρ
EXPORTS	16.423	4.515	-0.014	-1.915*	0.111	19.164*	-0.005
	(0.79)	(1.84)	(-0.41)	(-2.10)	(0.04)	(2.42)	(-0.01)
	$\bar{R}^2 = .81$		DW = 1.96				

Note: See note to Table 4.11.

TABLE 4.17

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH JAPAN (CORRECTED FOR AUTOCORRELATION)

	Intercept	LRGDP	$LRGNP_j$	LPMW	$LPXW_j$	LA_j	ρ
IMPORTS	-125.839*	5.143*	6.885	2.883	-8.637	15.172	-0.170
	(-2.19)	(2.15)	(1.64)	(1.25)	(-1.32)	(1.73)	(-0.37)
	$\bar{R}^2 = .82$		DW = 2.24				
	Intercept	LRGDP	$LRGNP_j$	LPXW	$LPMW_j$	LA_j	ρ
EXPORTS	54.580**	0.574	-4.512**	0.298	-0.152	-5.278**	-0.551*
	(8.76)	(1.79)	(-13.77)	(1.57)	(-0.41)	(-7.53)	(-2.39)
	$\bar{R}^2 = .95$		DW = 2.35				

Note: See note to Table 4.11.

TABLE 4.18

ESTIMATES OF SAUDI ARABIAN BILATERAL
TRADE WITH WEST GERMANY
(CORRECTED FOR AUTOCORRELATION)

	Intercept	LRGDP	$LRGNP_g$	LPMW	$LPXW_g$	LA_g	ρ
IMPORTS	137.777**	-0.268	-11.680*	3.199	-13.246**	-9.671*	0.895**
	(3.25)	(-0.34)	(-2.79)	(1.69)	(-3.98)	(-2.39)	(32.71)
	$\bar{R}^2 = .97$		DW = 2.32				
	Intercept	LRGDP	$LRGNP_g$	LPXW	$LPMW_g$	LA_g	ρ
EXPORTS	97.860**	2.362	-18.425**	-1.315	4.970	-24.457**	-0.624
	(4.02)	(1.39)	(-3.59)	(-1.55)	(1.35)	(-3.42)	(-1.46)
	$\bar{R}^2 = .69$		DW = 2.11				

Note: See note to Table 4.11.

TABLE 4 19

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH FRANCE (CORRECTED FOR AUTOCORRELATION)

	Intercept	LRGDP	$LRGNP_f$	LPMW	$LPXW_f$	LA_f	ρ
IMPORTS	-152 433 (-1 37)	1 718 (0 26)	18 769 (1 06)	4 568 (0 59)	-6 932 (-0 78)	23 748 (1 03)	-0 337 (-0 63)
	$\bar{R}^2$ = 54		DW = 1 11				
	Intercept	LRGDP	$LRGNP_f$	LPXW	$LPMW_f$	LA_f	ρ
EXPORTS	21 719* (2 16)	4 256** (5 53)	-4 462* (-2 57)	0 284 (1 31)	-3 043** (-3 06)	-4 432* (-2 01)	-0 474 (-1 71)
	$\bar{R}^2$ = 96		DW = 2 07				

Note See note to Table 4 11

TABLE 4 20

ESTIMATES OF SAUDI ARABIAN BILATERAL TRADE WITH THE UNITED KINGDOM (CORRECTED FOR AUTOCORRELATION)

	Intercept	LRGDP	$LRGNP_k$	LPMW	$LPXW_k$	LA_k	ρ
IMPORTS	11 978 (0 88)	0 665 (0 45)	-4 418* (-1 86)	13 982** (4 74)	-8 224** (-3 60)	5 912 (1 61)	-0 345* (-2 82)
	$\bar{R}^2$ = 93		DW = 2 47				
	Intercept	LRGDP	$LRGNP_k$	LPXW	$LPMW_k$	LA_k	ρ
EXPORTS	29 722** (3 01)	0 630 (0 49)	-8 878** (-3 81)	-0 961** (-3 29)	1 988 (1 16)	-12 847** (-4 03)	-0 542 (-1 76)
	$\bar{R}^2$ = 95		DW = 2 13				

Note See note to Table 4 11

For convenience, the symbols LRGDP, $LRGNP_i$ and LA_i have been defined previously, LPXW and $LPMW_i$ refer to the log of Saudi export unit value index and the log of country i's import unit value index, respectively

The only evidence of significant autocorrelation appears in the equations for the demand of France and the United Kingdom for Saudi exports Tables 4 16 - 4 20 provide the results for the corrected equations As shown in Tables 4 19 and 4 20, the estimated equations for France and the United Kingdom provide better estimates Thus, the new results for these two countries will be considered for the simulation part

The exchange rate term, LA_i, for export side is significant at the 5 percent level for all countries It also has the expected negative sign for all countries except the United States Although the importing country's GNP term is significant for four countries (with the exception of the United States), none of their estimated coefficients has the expected positive sign

The Saudi real GDP term is significant at the 5 percent significance level for three countries (the United States, Japan and France) and has a positive sign For the other two countries (West Germany and the United Kingdom) it is insignificant and also has a positive sign

In summary, there is a strong support for the hypotheses that exchange rate affects the value of bilateral trade (imports and exports) In other words, the results reported in Tables 4 11 - 4 20 indicate that changes in the bilateral riyal's value affect the Saudi trade balance with those five major trade partners However, and as it is the case for the aggregate model, the bilateral

exchange rate shows a greater impact on Saudi import demand than on the demand for its exports.

Pooling the Data

Since, it is common to pool data from all countries, a test was conducted for pooling the data and estimating the model with simultaneous equation techniques.[8] The reason is that pooling may yield better estimates by increasing the number of observations used in estimation. The null hypothesis to be tested is that coefficients across equations are equal (i.e. one equation can serve as a representative for the all five-country case both for imports and exports).

This was done both for import and export sides using an F-test. The F-ratio is:

$$F = \frac{(SSE_r - SSE_u)/K(P-1)}{SSE_u/P(T-K)}$$

where SSE_u = sum of squared error of the unrestricted model.

$= SSE_1 + SSE_2 + SSE_3 + SSE_4 + SSE_5$

SSE_i = SSE for the separate equations without pooling

and $i = 1, \ldots, 5$.

SSE_r = sum of squared error of the restricted model.

For the import side, the calculated value of the F-ratio statictic is 8.4078 and the tabulated value of F-statistic is 1.87. Thus, we reject the null

[8] Thursby and Thursby (1987), P. 491.

hypothesis that all coefficients across the five equations are the same. This means that pooling is not good.

For the export side, the calculated value of the F-ratio statistic is 13.9012 and the tabulated value of F-statistic is again 1.87. Consequently, we reject the null hypothesis of equality among coefficients across equations.

In both cases, the F-statistics are greater than the 5 percent significance level. The hypothesis of equality of coefficients across equation can be rejected. The estimation of separate equations for each country's imports and exports is appropriate.

Simulation of the Model

Equations of Saudi exports and imports at both aggregate and disaggregate levels were estimated and the impact of actual currency peg on the trade balance stability in the previous section. Next we conduct simulations to investigate the optimal currency peg for the Saudi riyal.

Based on Saudi official publications (mainly, SAMA's annual reports) and the publications of the IMF (especially, the Exchange Arrangements and Exchange Restrictions, annual report), it is clear that Saudi Arabia, adopted either the American dollar or the SDR peg during the period 1973-1986. The relevant question is the appropriateness of these arrangements. For example, would it be more appropriate for the currency to have been pegged to the yen mark, franc or pound instead? Would it have been more stable to use the dollar instead of the SDR peg and vice versa?

The value of the exchange rate that I have chosen to peg to is an average for the period. By recalculating the values of the effective exchange rate index

(EERI), the impact of changing the currency peg on the export and import equations and, consequently, on the Saudi trade balance may be considered. Thus, some policy implications and recommendations will be drawn.

The simulation approach conducted in this study is as follows. The estimated coefficients of the parameters and the actual values for the independent variables of the different equations are used to simulate paths for the dependent variables over the 1973-1986 period. These paths will be a result of employing different types of currency pegs. Comparing the actual dependent variables's value over that period with each of the simulated paths yields some error statistics. Based on these error statistics, the most appropriate currency peg for the riyal will be chosen. In addition, the variance of the predicted dependent variables using different currency pegs is used as another criterion.

Simulation Results

Aggregate Model. Table 4.21 presents the mean error (ME), the mean absolute error (MAE) and the root mean-squared error (RMSE) from predicted Saudi aggregate imports demand using different currency pegs. In that table, the SDR-peg has the lowest RMSE and the third lowest ME and MAE values. The U.S. dollar and yen pegs performed nearly as well. As for the other three currency pegs (DM, U.K. pound and FF), Table 4.21 shows clearly that on average, they underpredict the Saudi aggregate imports. Moreover, this table demonstrates that the French franc peg has the worst prediction performance.

Based on Figure 7, which plots the errors (actual minus predicted) in predicting Saudi aggregate imports, the SDR, U.S. dollar and yen pegs perform substantially better than the others in terms of predicting the Saudi

TABLE 4.21

ERROR STATISTICS FOR PROJECTED AGGREGATE IMPORTS
USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	Mean Error	Mean Absolute Error	Root Mean Squared Error
SDR	0.033	0.155	0.183
U.S. dollar	-0.027	0.156	0.185
Yen	0.009	0.133	0.198
DM	0.114	0.168	0.210
U.K. Pound	0.100	0.184	0.213
FF	0.119	0.208	0.241

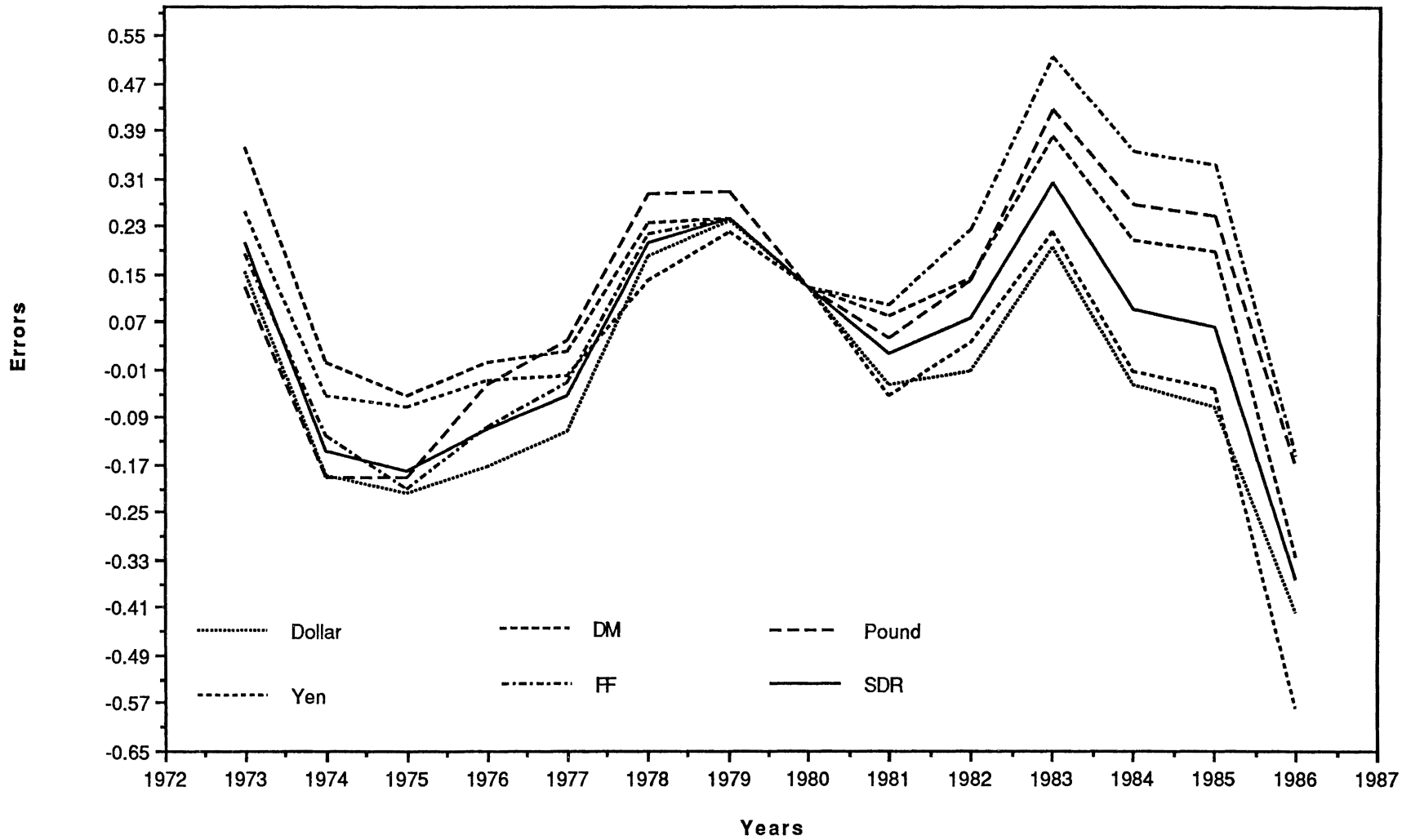


Figure 7: Errors in Projected Aggregate Imports Using Different Currency-Pegs

aggregate imports demand. This figure, also, present how the French fran peg underpredicts the Saudi aggregate imports real value by a substantial amount.

Comparing the numbers in Table 4.21 and Figure 7 for the different currency pegs, and based on RMSE, it is concluded that the SDR peg will provide the best prediction for the Saudi aggregate imports demand. This conclusion is supported by the results presented in Table 4.22 which shows the variances of projected Saudi imports (Var M) using the alternative exchange rate regimes. This table suggests that had the SDR peg been used, the Saudi aggregate imports demand would have yielded the lowest variance (0.036) followed by the U.S. dollar and yen pegs (0.037 and 0.042, respectively). In contrast, the French franc displays the largest variance among all the six types of currency pegs (0.085).

Table 4.23 reports the error statistics for projected aggregate exports using alternative exchange rate regimes. This table, also, shows that the SDR peg has the lowest MAE and RMSE and the second-lowest ME values. The U.S. dollar and yen pegs performed adequately. However, for the other three currency pegs (DM, U.K. pound and FF), Table 4.23 shows, on average, they overpredicted the Saudi aggregate exports real value. Once again, this table shows that the French franc peg has the worst prediction performance among all the six currency peg used in this study.

Some interesting results can be obtained by looking at Figure 8 which plots the errors in projected Saudi aggregate exports using different currency pegs. While they are more disparate than those of the imports side, the various exports prediction errors in Figure 7 tell a similar story where the SDR, U.S. dollar and yen pegs, generally, show the best performances.

TABLE 4.22

VARIANCES OF PROJECTED AGGREGATE IMPORTS, EXPORTS AND TRADE BALANCE USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	Var (X)	Var (M)	Cov (X,M)	Var (TB)
SDR	0.0082	0.0360	-0.0098	0.0638
U.S. dollar	0.0094	0.0370	-0.0116	0.0696
Yen	0.0108	0.0423	-0.0136	0.0803
DM	0.0175	0.0475	-0.0170	0.0990
U.K. pound	0.0267	0.0490	-0.0272	0.1301
FF	0.0393	0.0850	-0.0400	0.2043

TABLE 4.23

ERROR STATISTICS FOR PROJECTED AGGREGATE EXPORTS
USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	Mean Error	Mean Absolute Error	Root Mean Squared Error
SDR	-0.024	0.077	0.008
U.S. dollar	0.035	0.081	0.009
Yen	0.005	0.079	0.010
DM	-0.097	0.101	0.016
U.K. Pound	-0.099	0.132	0.025
FF	-0.115	0.150	0.036

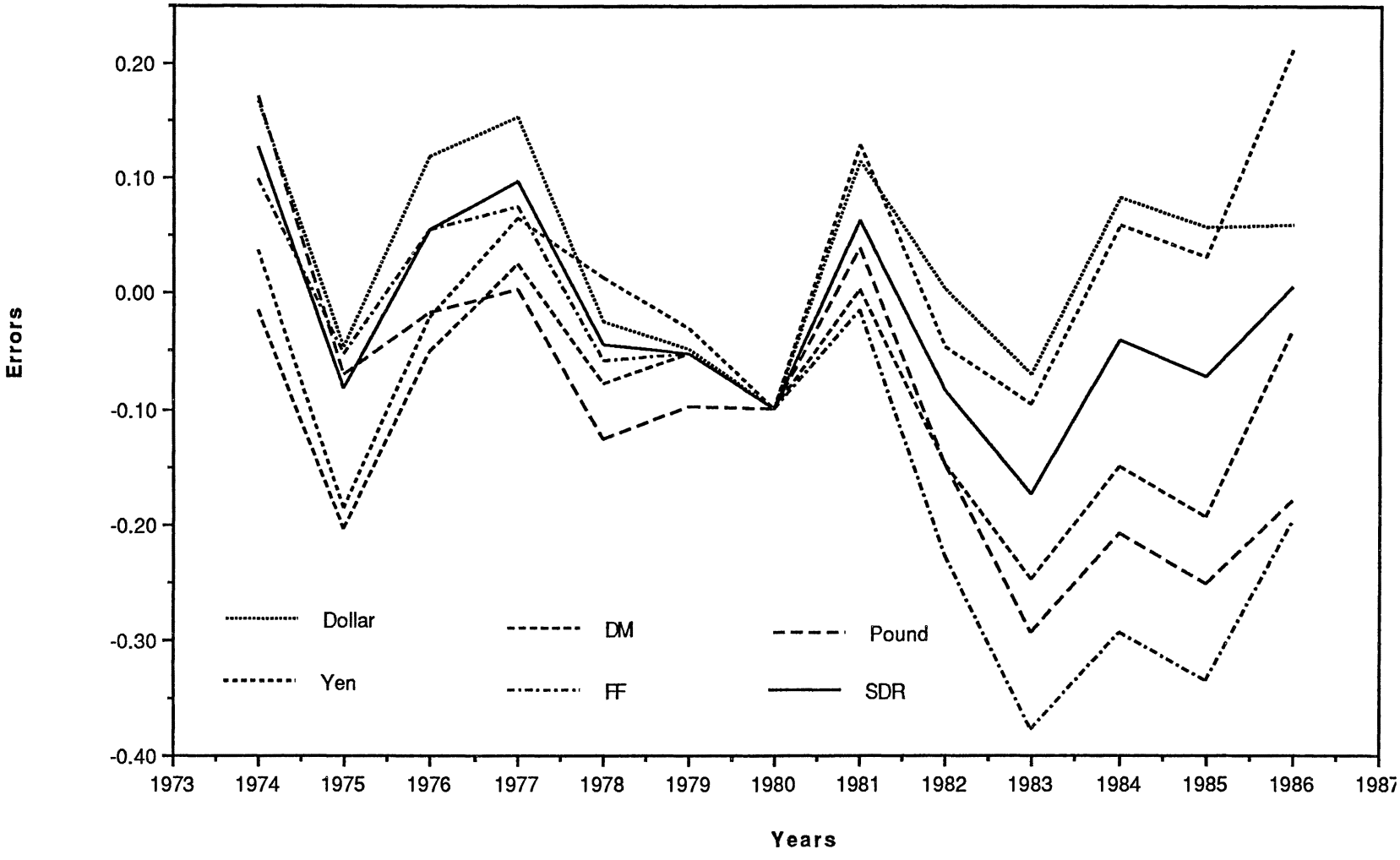


Figure 8: Errors in Projected Aggregate Exports Using Different Currency-Pegs.

Furthermore, this figure shows, clearly, how the French franc overpredicts the Saudi aggregate exports.

Comparing the numbers in Table 4.23 and Figure 8 for the different currency pegs, it is concluded that the SDR peg will provide the best prediction for the Saudi aggregate export demand. Table 4.22, which shows the variances of projected Saudi exports using alternative exchange rate regimes [Var(X)], supports this conclusion. This table, also, suggest that had the SDR peg been used, the Saudi aggregate exports demand would have yielded the lowest variance (0.0082) followed by the U.S. dollar and yen pegs (0.0094 and 0.0108, rspectively). The table shows, once again, that the French franc has the largest variance among all the six types of currency pegs (0.0393).

The last column of Table 4.22 shows the variance of the trade balance. The result of that column is in agreement with those discussed above for both Saudi aggregate imports and exports. This table suggest that had the SDR peg been used, the Saudi trade balance would have yielded the lowest variance (0.0638) followed by the U.S. dollar and yen pegs (0.0696 and 0.0803, respectively). Moreover, the French franc performs poorly showing the largest variance among the six types of currency pegs (0.2043).

Disaggregate Model

Tables 4.24 - 4.28 presents the variances of projected Saudi imports from its major trade partners, Var (M_i), using alternative exchange rate regimes. Those tables suggest that had the U.S. dollar peg been used, the Saudi imports demand from its major trade partners would have yielded the

lowest variance followed by the SDR and DM pegs. In contrast, the French franc shows the largest variance among all the six currency pegs.

Tables 4.24 - 4.28 also shows the variances of projected Saudi exports to its major trade partners, Var (X_i), using alternative exchange rate regimes. Those tables also suggest that had the U.S. dollar peg been used, the Saudi exports demanded by each trade partner separately would have yielded the lowest variance followed by the SDR and DM pegs. Moreover, the tables present that the French franc, as before, has the largest variances among all the six currency pet for all the five countries.

The results of the last columns of Tables 4.24 - 4.28 is in an agreement with those discussed above for both Saudi imports from and exports to its major trade partners. The last column of Tables 4.24 - 4.28 shows the variances of projected Saudi trade balance with its major trade partners, Var (TB_i), using alternative exchange regimes. Once again, those tables suggest that had the U.S. dollar peg been used, the Saudi trade balance with its major trade partners would have yielded the lowest variances followed by the SDR and DM pegs. As before, the French franc shows the largest variances among all the six currency pegs for all the five countries.

TABLE 4.24

VARIANCES OF PROJECTED SAUDI ARABIAN IMPORTS FROM, EXPORTS TO AND TRADE BALANCE WITH THE UNITED STATES USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	$Var(X_S)$	$Var(M_S)$	$Cov(X_S,M_S)$	$Var(TB_S)$
U.S. dollar	0.5674	1.2586	0.7739	0.2783
SDR	3.0396	8.7106	5.0975	1.5552
DM	7.0530	17.6564	11.0920	2.5254
Yen	10.7660	25.8728	16.6184	3.4019
U.K. Pound	18.5789	45.1746	28.9016	5.9502
FF	30.4824	74.2779	47.5167	9.7270

TABLE 4.25

VARIANCES OF PROJECTED SAUDI ARABIAN IMPORTS FROM, EXPORTS TO AND TRADE BALANCE WITH JAPAN USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	$Var(X_j)$	$Var(M_j)$	$Cov(X_j,M_j)$	$Var(TB_j)$
U.S. dollar	0.0204	0.2212	-0.0540	0.3495
SDR	0.1535	1.0596	-0.3881	1.9893
DM	0.3454	2.1459	-0.8449	4.1809
Yen	0.4816	2.9243	-1.1706	5.7471
U.K. Pound	0.8356	5.3552	-2.1003	10.3915
FF	1.4042	8.5743	-3.4539	16.8863

TABLE 4.26

VARIANCES OF PROJECTED SAUDI ARABIAN IMPORTS FROM, EXPORTS TO AND TRADE BALANCE WITH WEST GERMANY USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	$Var(X_g)$	$Var(M_g)$	$Cov(X_g,M_g)$	$Var(TB_g)$
U.S. dollar	0.3693	0.2053	-0.2136	1.0017
SDR	2.1222	0.5563	-0.9997	4.6779
DM	4.3937	0.8864	-1.8694	9.0190
Yen	6.3744	1.3203	-2.8022	13.2990
U.K. Pound	11.4711	2.3967	-5.1546	24.1769
FF	18.5081	3.3823	-7.8047	37.4998

TABLE 4.27

VARIANCES OF PROJECTED SAUDI ARABIAN IMPORTS FROM, EXPORTS TO AND TRADE BALANCE WITH FRANCE USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	$Var(X_f)$	$Var(M_f)$	$Cov(X_f,M_f)$	$Var(TB_f)$
U.S. dollar	0.0403	1.5480	-0.1556	1.8993
SDR	0.1575	5.9161	-0.8746	7.8227
DM	0.3406	11.4586	-1.8820	15.5633
Yen	0.4910	16.9999	-2.7991	23.0891
U.K. Pound	0.7817	27.3079	-4.5353	37.1601
FF	1.3582	43.3189	-7.5766	59.8303

TABLE 4.28

VARIANCES OF PROJECTED SAUDI ARABIAN IMPORTS FROM, EXPORTS TO AND TRADE BALANCE WITH THE UNITED KINGDOM USING ALTERNATIVE EXCHANGE RATE REGIMES

Type of Peg	$Var(X_k)$	$Var(M_k)$	$Cov(X_k,M_k)$	$Var(TB_k)$
U.S. dollar	0.1145	0.3824	-0.0667	0.6302
SDR	0.4817	0.6707	-0.6454	2.4432
DM	0.9389	1.1217	-1.4670	4.9946
Yen	1.3758	1.3670	-2.0269	6.7966
U.K. Pound	2.3800	1.4213	-2.7243	9.2499
FF	3.9293	2.4516	-4.9351	16.2511

CHAPTER V

CONCLUSIONS

Fluctuations in the exchange rate are thought to affect a wide variety of economic variables. This study has focused on the issue of the optimum exchange rate regime for an oil-exporting country, Saudi Arabia. How important is the exchange rate for the oil-exporting countries' development prospects? Oil-exporting countries produce a depletable resource (oil). Therefore, a policy of diversification of exports which encourages non-oil exports has been implemented. This new direction makes the exchange rate particularly important for the oil-exporting countries' development prospects. This study has focused on the impact of fluctuations in the exchange rate of the riyal on both Saudi imports and exports and, therefore, on the trade balance.

The purpose of this study is two-fold. First, to provide new estimates of both aggregate and disaggregate import and export demand equations for Saudi Arabia using annual data on the relevant variables for the period 1973-1986. Second, to investigate and determine empirically the optimum currency peg for the Saudi riyal.

To accomplish this goal, a simple trade model, that includes variables found in the literature on import and export demand was used. An exchange rate term was added separately to assess the effect of exchange rate on the trade flows.

Using Saudi exports and imports, the analysis showed that different currency pegs yield significant differences in the estimated effect of exchange rates on trade flows. Furthermore, the analysis showed that different currency pegs exhibit substantial differences in their ability to predict the values of exports and imports.

The present study leads to a number of conclusions. They are summarized in the following:

1. The exchange rate has a significant impact on the trade flows of Saudi Arabia. This conclusion can be drawn from the results of Tables 4.2 and 4.6. It was shown that a one percent appreciation of the riyal will generate an increase in the aggregate imports of 0.54 percent whereas a depreciation of the riyal by one percent will improve the aggregate exports by 0.52 percent. Thus, the results reported imply that changes in the riyal's value affect the Saudi trade balance. Furthermore, the exchange rate has a more powerful effect on aggregate imports demand than on the world demand for its export because exports are denominated in U.S. dollars, therefore currency changes are not expected to be significant.

2. The relative prices have also shown a significant impact on trade flows of Saudi Arabia. An increase in the relative prices of aggregate imports by one percent will cause a decline in the aggregate imports by 2.03 percent. On the other hand, an increase in the relative prices of aggregate exports by one percent will lead to a deterioration in the world demand for Saudi aggregate exports by 0.94 percent. This conclusion leads to a very important policy implication. By looking to the values of the price elasticities of aggregate imports and exports mentioned above, it is clear that the Marshall-Lerner

condition for a successful devaluation would be easily satisfied. This policy implication is in agreement with those reached by previous studies such as Hafiz (1981) and Tawi (1989).

3. The real income terms have also indicated a significant impact on the Saudi trade flows. An increase in Saudi real GDP by one percent will yield an increase in the Saudi aggregate imports by 2.84 percent and an increase in the world real income by one percent will yield an increase in the world demand for Saudi exports by 2.50 percent. It is clear that the Saudi income elasticity for imports is larger than the income elasticity of demand for its exports. This would imply that, other things equal, if the world real income increased at a uniform rate, the Saudi riyal would tend to depreciate.

4. It appears from the results of this study that formulations with only relative prices, real income and exchange rate as explanatory variables are appropriate for explaining a large proportion of the aggregate Saudi imports and exports variations.

5. There is also strong support for the hypothesis that exchange rate affects the value of Saudi bilateral trade with five major trade partners. The exchange rate term for the exports side appears to be significant for all the five cases and has the expected negative sign for all countries except the United States. The exchange rate term for the import side has its expected positive sign for the five cases. However, it appears to be significant for the cases of the United States, Japan and the United Kingdom. Moreover, it turns out to be insignificant for the cases of West Germany and France.

6. On the aggregate level, the SDR peg seems to be the best currency peg for the Saudi riyal in terms of minimizing the variance of the trade balance.

This is no wonder since Saudi Arabia has an open economy where trade (both exports and imports) are so high as a percentage of the GDP. Thus, trade is playing a crucial role in the Saudi economic development process. At the same time Saudi Arabia does not depend heavily on one trade partner. Since the SDR unit composes the currencies of the five major trade partners of Saudi Arabia and since the SDR peg yields the best results (the best prediction error and the lowest variance), it is concluded that pegging the Saudi riyal to the SDR is the optimal currency peg.

7. On the disaggregate level, the U.S. dollar provides the best performance and yields the best results among all the six currency pegs considered in this study. The U.S. dollar dominates the rest of the currencies including the SDR. This conclusion may be attributed to the fact that the major export (oil) is priced in dollars.

There have been a few studies conducted to investigate the imports and exports of developing countries on a disaggregate level. This is because of lack of adequate data, especially the data on prices of disaggregated imports and exports. Saudi Arabia is no exception in this matter. This study is limited by data problems such as those on disaggregated investment abroad by countries, bilateral imports and exports prices and the Saudi non-oil export prices. The availability of such data may provide better insight and more powerful conclusions.

As the findings of this study are for one set of currencies and for a specific historical period, they should not be taken as general policy implications. Generalizing these findings should be done with care.

For conducting this study, only five major currencies were utilized to compute the EERI. This number of currencies may be criticized as too narrow to reflect the movements of the riyal accurately. Therefore, since the set of currencies included in the EERI and their weighting scheme affect the interpretation of the results, it is recommended that future research use a greater number of trade partners for calculating the EERI.

Finally, it should be stressed that this study is not a general equilibrium type of study. Hence, the results do not reflect changes in all sectors of the economy and the choice of the exchange rate regime depends on the criterion used (in this study, minimizing the variance of the trade balance). Of course, a policy of minimizing the impact of foreign currency fluctuations on a specific variable may not necessarily minimize the impact of those fluctuations on other variables.

BIBLIOGRAPHY

Amuzegar, J. (1983). Oil exporters' economic development in an interdependent world. IMF Occassional Papers, no. 18.

Aizenman, J. (1983). On the optimal combination of commercial and exchange rate policies. Southern Economic Journal, 50, 1985-94.

Bacha, E. L. (1981). The impact of the float on LDCs: Latin American experience in the 1970s. In J. Williamson (Ed.), Exchange rate rules. Macmillan, London.

Bahmani-Oskooee, M. (1984). On the effects of exchange rates on trade flows. The Indian Journal of Economics, July, 57-67.

Bahmani-Oskooee, M. (1986). Determinants of international trade flows: The case of developing countries. Journal of development economics, 20, 107-123.

Balassa, B. (1986). Effects of exchange rate changes in developing countries. The Indian Journal of Economics, 20, 203-221.

Batten, D. S. and Belongia, M. T. (1984). The recent decline in agricultural exports: Is the exchange rate the culprit? Federal Reserve Bank of St. . Louis Review, October, 5-14.

Batten, D. S. and Belongia, M. T. (1987). Do the new exchange rate indexes offer better answers to old questions? Federal Reserve Bank of St. Louis Review, May, 5-17.

Bautista, R. M. (1982). Exchange rate variations and export competitiveness in less developed countries under generalized floating. The Journal of Development Studies, 18 (3), 354-378.

Belongia, M. T. (1986). Estimating exchange rate effect on exports: A cautionary note. Federal Reserve Bank of St. Louis Review, January, 5-16.

Bird, G. (1979). The choice of exchange rate regime in developing countries. Phillippine Economic Journal, 18 (2), 148-162.

Black, S. W. (1976). Exchange policies for less developed countries in a world of floating rates. Princeton Essays in International Finance, no. 119.

Bosco, L. (1987). Determinants of the exchange rate regimes in LDCs: Some empirical evidence. Economic Notes, (1), 110-143.

Branson, W. H. and Katseli-Papaefstratiou, L. T. (1980). Income instability, terms of trade, and the choice of an exchange rate regime. Journal of Development Economics, (7), 49-69.

Cline, W. R. (1976). International monetary reform and the developing countries. Washington, D.C.: The Brookings Institution.

Connolly, M. (1982). The choice of an optimum currency peg for a small open country. Journal of International Money and Finance, (1), 153-164.

Connolly, M. (1983). Optimum currency pegs for Latin America. Journal of Money, Credit and Banking, 15 (1), 56-72.

Crockett, A. D. and Nsouli, S. M. (1977). Exchange rate policies for developing countries. Journal of Development Studies, January, 125-143.

Diag-Alejandro, C. L. (1975). Less developed countries and the post-1971 international financial system. Princeton Essays in International Finance, no. 108.

Dreyer, J. S. (1978). Determinants of exchange-rate regimes for currencies of developing countries: Some preliminary results. World Development, 6, 437-445.

El Mallakh, R. (1982). Saudi Arabia: Rush to development. Baltimore, Maryland: John Hopkins University.

El Mallakh, R. and El Mallakh, D. (Ed.). (1982). Saudi Arabia: Energy, development planning, and industrialization. Lexington, Massachusetts: Lexington Books.

Fischer, S. (1977). Stability and exchange rate system in a monetarist model of the balance of payments. In R. Aliber (Ed,), The Political Economy of Monetary Reform. Montclair, N.J.: Allanheld, Osmun and Co.

Flanders, M. and Helpman, E. (1979). An optimal exchange rate peg in a world of generalized floating. Review of Economic Studies, July, 533-542.

Flood, R. P. (1979). Capital mobility and the choice of exchange rate system. International Economic Review, 20, June, 405-16.

Frenkel, J. and Aizenman, J. (1982). Aspects of the optimal management of exchange rates. Journal of International Economics, 13, 231-56.

Gafar, J. (1981). Devaluation and the balance of payments adjustment in a developing economy: An analysis relating to Jamaica: 1954-72. Applied Economics, 13, 151-165.

Gerakis, A. (1975). Pegging to the SDR: The experience of Iran, Jordan, Qatar, and Saudi Arabia. Finance and Development, 35-8.

Goldstein, M. and Khan, M.S. (1976). Large versus small price changes and the demand for imports. IMF Staff Papers, 23, 200-225.

Goldstein, M. and Khan, M.S. (1978). The supply and demand for exports: A simultaneous approach. The review of economics and statistics, 61, 275-86. IMF Staff Papers, 23, 200-225.

Hafiz, O. (1981). A Foreign Trade Model for Saudi Arabia: An Econometric Approach. (Unpublished Ph.D. dissertation, Indiana University, Bloomington, Indiana).

Heller, H. R. (1977). Choosing an exchange rate system. Finance and Development, 14 (2), 23-27.

Heller, H. R. (1978). Determinants of exchange rate practices. Journal of Money, Credit, and Banking, 10 (3), 308-321.

Holden, P., Holden, M., and Suss, E. C. (1979). The determinants of exchange rate flexibility: An empirical investigation. Review of Economics and Statistics, 61, 327-333.

Houthakker, H. S. and Magee, S. P. (1969). Income and price elasticities in world trade. The Review of Economic Studies, 51, 111-125.

International Monetary Fund. Exchange Arrangements and Exchange Restrictions, Annual Report. Various issues. Washington, D.C.

International Monetary Fund. International Financial Statistics. Various issues. Washington, D.C.

International Monetary Fund. (1984). Exchange Rate Volatility and World Trade. IMF Occassional Papers, no. 28.

International Monetary Fund. (1987). The Role of the SDR in the International Monetary System. IMF Occassional Papers, no. 51.

Ishiyama, Y. (1975). The theory of optimum currency areas: A survey. IMF Staff Papers, July.

Khan, M. S. (1974). Import and export demand in developing countries. IMF Staff Papers, 21, 678-693.

Khan, M. S. (1975). The structure and behavior of imports of Venezuela. Review of Economics and Statistics, 57, 221-24.

Khan, M. S. and Ross, K. (1975). Cyclical and secular income elasticities of the demand for imports. Review of Economics and Statistics, 57, 357-361.

Knauerhase, R. (1983). Saudi Arabia: Fifty years of economic change. Current History, January, 19-23 and 35-36.

Leamer, E. E. and Stern, R. M. (1970). Quantitative International Economics. Chicago: Allyn and Bacon, Inc.

Lipschitz, L. (1978). Exchange rate policies for developing countries: Some simple arguments for intervention. IMF Staff Papers, 25, Sept., 650-675.

Lipschitz, L. (1979). Exchange rate policy for a small developing, and the selection of an appropriate standard. IMF Staff Papers, 26, Sept., 423-449.

Lipschitz, L. and Sundararajan, V. (1980). Pegging to a currency basket in a world of floating rates. Finance and Development, June, 25-28.

Lipschitz, L. and Sundararajan, V. (1980a). The optimal basket in a world of generalized floating. IMF Staff Papers, March, 80-100.

Lipschitz, L. and Sundararajan, V. (1980b). An optimal exchange rate peg in a world of generalized floating - Extension and comments, Mimeo.

Lipschitz, L. and Sundararajan, V. (1980c). The optimal currency basket in a world of generalized floating with price uncertainty. In M. Connolly (Ed.), The International Monetary System: Choices for the Future. New York, N.Y., Praeger Special Studies, Praeger Scientific.

Looney, R. (1982). Saudi Arabia's development potential. Lexington, Massachusetts: Lexington Books.

Melvin, M. (1985). The choice of an exchange rate system and macroeconomic stability. Journal of Money, Credit, and Banking, 17, 467-478.

Ministry of Planning. (1980). Third Development Plan, 1980-1985. Riyadh, Saudi Arabia: Ministry of Planning Press.

Ministry of Planning. (1986). Achievements of the Development Plans 1390-1405 (1970-1985): Facts and figures. Riyadh, Saudi Arabia: Ministry of Planning Press.

Ministry of Planning. (1985). Fourth Development Plan, 1985-1990. Riyadh, Saudi Arabia: Ministry of Planning Press.

Mohtadi, S. (1988). The stabilization of the effective exchange rates of the less developed countries under alternative exchange rate arrangements. Journal of Economic Development, 13 (1), 143-154.

Mundell, R. (1961). A theory of optimum currency areas. American Economic Review, 51, Sept., 657-665.

Nascimento, J. (1987). The choice of an optimum exchange currency regime for a small economy: An econometric analysis. Journal of Development Economics, 25, 149-165.

Ott, M. (1987). The dollar's effective exchange rate: Assessing the impact of alternative weighting schemes. Federal Reserve Bank of St. Louis Review, February, 5-14.

Pearce, D. (1984). The Dictionary of Modern Economics. Cambridge, Massachusetts: The MIT Press.

Polak, J. J. (1979). The SDR as a basket of currencies. IMF Staff Papers, 26, 627-653.

Saleh-Isfahami, D. (1989). Oil exports, real exchange rate appreciation, and demand for imports in Nigeria. Economic Development and Cultural Change, 495-512.

Salvatore, D. (1984). Theory and Problems of International Economics. NY, NY: McGraw-Hill Book Company.

Saudi Arabian Monetary Agency. Annual Report, various issues. Riyadh, Saudi Arabia: SAMA.

Tawi, S. (1989). The Impact of Expatriate Workers on the Economy of Saudi Arabia - "A Computable General Equilibrium Results". (Unpublished Ph.D. dissertation, Oklahoma State University, Stillwater, Oklahoma).

Thursby, J. G. and Thursby, M. C. (1987). Bilateral trade flows, the linder hypothesis, and exchange risk. The Review of Economics and Statistics, 488-495.

Tower, E. and Willet, T. D. (1976). The theory of optimum areas and exchange rate flexibility. Special Papers in International Economics, no. 11, May.

Turnovsky, S. (1968). International trading relationships for a small country: The case of New Zealand. Canadian Journal of Economics, 4, Nov., 772-90.

United Nations. Yearbook of International Trade Statistics, various issues New York, United Nations Publishing Services.

Warner, D. and Kreinin, M. E. (1983). Determinant of international trade flows. The Review of Economics and Statistics, 65, Feb., 96-104.

Wickham, P. (1985). The choice of exchange rate regime in developing countries - A survey of the literature. IMF Staff Papers, 32, 248-288.

Williamson, J. (1982). A survey of the literature on the optimal peg. Journal of Development Economics, 11, 39-61.

Wilson, J. F. and Takacs, W. E. (1979). Differential responses to price and exchange rate influences in the foreign trade of selected industrial countries. The Review of Eocnomics and Statistics, 61, May, 267-279.

Yousef, A. (1981). An Optimum Currency Peg for Developing Countries: The Case of Fifteen Arab Countries. (Unpublished Ph.D. dissertation, University of South Carolina, Columbia, South Carolina).

VITA

Mosaed S. Almasbahi

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE OPTIMAL CURRENCY-PEG FOR AN OIL-EXPORTING COUNTRY: THE CASE OF SAUDI ARABIA

Major Field: Economics

Biographical:

Personal Data: Born in Riyadh, Saudi Arabia, December 12, 1957, the son of Saleh Almasbahi and Norah Al-Laifan.

Education: Graduated from King Abdul Aziz High School in 1975; received a Bachelor of Commerce Degree in Economics from King Saud University, Riyadh, Saudi Arabia, in 1979; received a Master of Science Degree from Iowa State University, Ames, Iowa, in 1984; completed requirements for the Doctor of Philosophy Degree at Oklahoma State University in May, 1990.

Professional Experience: Teaching Assistant, Department of Economics, King Saud University, Riyadh, Saudi Arabia, 1979 - 1980.