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An Economic Analysis of Foreign Assets, Money Supply, and Inflation in Saudi Arabia, 1963-83

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AN ECONOMIC ANALYSIS OF FOREIGN ASSETS, MONEY SUPPLY, AND INFLATION IN SAUDI ARABIA, 1963-83

by

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in

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Dedicated to the Memory of My Late Father:

Ahmed Mesfer Khalofa
(May His Soul Rest in Peace)

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Said A. Khalofa

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ABSTRACT

An Economic Analysis of Foreign Assets, Money Supply,

and Inflation in Saudi Arabia, 1963-83

by

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Utah State University, 1985

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Until the discovery of oil in Saudi Arabia, the West knew very little about the economic aspects of the country. Since then, foreign assets have grown, and the balance of payment of Saudi Arabia have reflected an accumulation of continuously rising surpluses, particularly after 1973. Real income increased and consequently, supply and demand for money increased.

During the period 1974-77, the Saudi economy experienced a high rate of inflation, but during the subsequent years (the late 1970s and the early 1980s) the Saudi inflation rate began declining.

The main objective of the present study is to conduct an empirical investigation analyzing the interrelationships among foreign assets, money supply, and the domestic inflation in Saudi Arabia utilizing a model incorporating traded and nontraded goods.

The theoretical model produces the final two equations where inflation generated in the nontraded goods sector and the overall domestic inflation represent the dependent variables, while the rate of

change in the excess supply of money, world inflation, and the rate of change in last years inflation represent the explanatory variables for both dependent variables.

The empirical analysis reveals no significant relationship between the behavior of the excess supply of money and the behavior of inflation in Saudi Arabian economy during the entire period of study (1963-83). It indicates that neither money supply nor foreign assets has played an active role in determining the behavior of domestic inflation in the Saudi Arabian economy.

A strong relationship has been found between the inflationary expectations of the public and the inflation generated in the nontraded goods sector. During the period (1963-72) imported inflation explained significantly the overall domestic inflation. But this is not so for the second period (1973-83) of study, even though inflation peaked during 1974-77. Futhermore, no structural shift in the economy occurred between these two subperiods.

The causality test conducted confirms the empirical results where no unidirectional causality existed between the overall domestic inflation rate and the excess supply of money. However, a positive causality has been found between the world inflation rate and the Saudi overall domestic inflation rate.

Another unidirectional causality from inflation generated in the nontradable sector to the overall domestic inflation rate has been found. Finally, the implications of the results are discussed.

(147 pages)

CHAPTER I

INTRODUCTION

The change of the oil industry structure and pricing policy in 1973-74 created a remarkable departure from the past in the history of the Saudi Arabian economy. The economy of the Kingdom of Saudi Arabia is, basically, a one-resource economy; its major economic resource is the huge deposit of crude oil. A large share of the economic activities in the country are based on the production of crude oil, its refinement, and sale in other countries of the world.

Oil industry structural changes in the Kingdom of Saudi Arabia began in 1973 when the government realized the importance of gaining control over its major source of revenue. It took the first step by the acquisition of 25% of the shares in ARAMCO's producing assets. This was followed by another agreement in 1974, allowing the government participation in ARAMCO's producing assets to become 60%, and, finally, in 1975, there was an agreement allowing a 100% transfer of ownership to the government of Saudi Arabia.

Oil production and marketing policies prior to 1973 had been controlled by the operating companies, and, thus, the government revenue was controlled by them, too. Price policies reflected the long-run costs of production as viewed by the operating companies. Between mid-1970 and mid-1973, Saudi Arabian oil production increased from 3.5 million barrels/day to 7.5 million barrels/day (Johany, 1980).

The government's share of the total oil revenue was relatively small. Before December 1973, the price per barrel of refined oil products in Western Europe was approximately $14.50, which could be divided into three parts: 51% (approximately $7.40) was the tax in the consuming countries, 16% (approximately $2.30) was the share of the producing government, and 33% (approximately $4.70) was the cost and profit to the oil industry. There was a downward trend of oil prices before 1973. The price was $1.93 a barrel of oil in 1955, $1.33 a barrel in 1960, and $1.30 a barrel in 1970. When the government took over production and marketing policies in 1973, a new era began in which prices reflected the long-run production costs as viewed by the oil-producing nations (Johany, 1980).

After 1973, prices went up dramatically from $3.011 to $5.119 a barrel in 1973, and to $11.65 a barrel for the Arabian Light 34°, during the OPEC conference in Tehran in December 1973. Spot prices increased even more.

The Iranian Revolution in 1978 was a major reason for further increases in oil prices, due to the consuming nations' expectations about the future of oil supplies. Thus, the price of oil increased from $12.70 in 1978, to $24 by December 1979, and reached $26 a barrel in 1980, while spot prices almost doubled that amount to $45 a barrel.

Saudi Arabian oil production after 1973 maintained an average of 7.5 million barrels/day. The government of Saudi Arabia adjusted its production several times, according to its policies and to fill its obligations toward the stability of oil prices in the world market. Because of the reduction in oil supplies in the world market in 1978, by more than three million barrels a day, due to the political crisis in

Iran, Saudi Arabia increased its output of oil by 40% up to its maximum capacity of an excess of 10 million barrels a day to prevent a sharp rise in oil prices on the world market (Moliver and Abbondante, 1980).

The sudden change in oil industry ownership accompanied by the changes in oil prices had great effects over all aspects of economic activities in the Kingdom of Saudi Arabia. This study analyzes the macroeconomic impact of the changes in the balance of payments on money supply and domestic inflation.

After 1973, the oil industry was integrated totally into the country's economy, where on the average, more than 80% of the Gross Domestic Product came from the production of crude oil. The massive financial resources generated by the daily production of crude oil gave the country an opportunity to diversify its resources and take further steps toward industrialization. However, the road to industrialization is not without obstacles and problems--problems related to the ability of the economy to achieve development. Some factors of production are either not available or are available at a cost that makes the rate of return on investments lower than what can be obtained from investing abroad.

The Kingdom of Saudi Arabia is one of the greatest financial capital-abundant countries in the world. It has one of the fastest growing economies, but it cannot, by any means, absorb the huge daily oil revenue due to a limitation in capacity and shortages in some of the other factors of production. Evaluation of the Saudi Arabian economy has led to the belief that it could be classified as a low absorber of oil money.

Another problem facing Saudi Arabia is inflation. The Kingdom has a unique financial system, where the source of payment is the public sector. The government finances all its expenditures by writing checks on the Saudi Arabian Monetary Agency (SAMA), the Central Bank of the country. Then, SAMA converts those checks into equivalent amounts of Saudi Riyals, which come into circulation in the economy. Until 1973, Saudi Arabia successfully managed to have a low rate of inflation. However, for some years after 1973, especially during 1974-75, the rate of inflation accelerated as a result of the oil price increases, which brought about a large increase in the government oil revenues and expenditures. Since oil is an exhaustible resource, government expenditures increased for development projects to create and develop other sources of income. Those policies, in turn, increased money in circulation, and consequently, the aggregate demand increased. However, aggregate supply did not match the increase in aggregate demand due to a lack of importing facilities.

The question now is, can the government maintain its control over the domestic rate of inflation effectively and continuously in one of the most open economies of the world, regardless of world inflation rates in the face of rising accumulation of financial assets of the country?

State of the Problem and Significance of the Study

The high rate of inflation that has occurred in Saudi Arabia during the 1970s, especially after 1973 (the oil-price increase period), has been accompanied by increasingly larger balance-of-payments surpluses that have resulted in a steep growth of the Saudi Arabian Monetary Agency's (SAMA) foreign assets.

This study is concerned with analyzing the interrelationships between the economic variables, foreign assets, money supply, and inflation in the Saudi Arabian economy. Foreign assets and not foreign reserves have been chosen as one of the determinants of the money supply because the former represents a reasonable proxy for Saudi Arabia's true levels of international reserves.

Studying the link between these economic variables serves as a tool for analyzing a given economic problem and helps provide the economic decision makers with the knowledge and a foundation to guide them in rational decisionmaking.

The foreign trade sector and related aspects play an important and vital role in the Saudi Arabian economy. Without the revenue from oil exports, the wheel of development in Saudi Arabia would be stopped, and the total welfare of the nation would be reduced.

Empirical works on this subject are very limited. To my knowledge, the only empirical work on this topic, by Donald M. Moliver and Paul J. Abbondante (1980), found a positive relationship between the growth of base money and the money supply, but a weak relationship between international reserves and the growth of the price level. The most surprising result of the study was the absence of a positive relationship between international reserves and the monetary base.

The type of information that will be provided by this study will be to some extent different. The study utilizes the traded and nontraded goods model for the purpose of identifying inflation rate caused by imported goods and services, and the rate of inflation caused by nontraded goods and services, in addition to studying the causality ordering across the variables of concern.

Objectives and Procedures

To date, no sound economic investigation of the interrelationships among foreign assets, money supply, and the domestic inflation rate in the Saudi Arabian economy has been made. This study intends to partially fill that gap. The objectives of the present study are:

1. To describe the most important macroeconomic variables in the Saudi Arabian economy.
2. To build a theoretical framework for analyzing the relationships among the following variables: foreign assets, the money supply, and domestic inflation in the Saudi Arabian economy.
3. To test the theoretical model empirically, and
4. To derive the policy implications of the study.

This study will utilize the usual research procedures in economics wherein a theoretical model with specific implications is derived and then tested empirically. The available data will be analyzed with a time-series least-squares regression technique (OLSQ) and/or with the Cochrane-Orcutt technique in the presence of serial correlation of residuals.

Organization of the Study

This study is organized in six chapters as follows:

Chapter One

The first chapter introduces the problem, delineates the significance of the study, and outlines objectives and procedures.

Chapter Two

This chapter sketches the historical background and the structure of the Saudi Arabian economy and is subdivided into two sections. The first is concerned with the historical background of oil exploration and extraction in Saudi Arabia. This section is subdivided into three subsections. The first discusses the period up to 1960 (international companies domination and no government participation). The second focuses on the discussion of the public sector operations, the period from 1962 to 1973. The third subsection is concerned with government ownership, 1973, and the establishment of OPEC. The second section of this chapter describes some macroeconomic variables in Saudi Arabia, 1963-82.

Chapter Three

This chapter reviews the literature related to the subject. The first section reviews various balance-of-payments theories. The second section focuses on the relationship between foreign reserves and inflation. The third section concentrates on inflation caused by excess foreign reserves (balance of payments surpluses). The fourth section explains the relationship between the exchange rate system and inflation. The final section discusses various types of inflation costs.

Chapter Four

In this chapter an inflation model for the Saudi Arabian economy is constructed based on a traded and nontraded goods model in the first section. In the second section, the sources of data used in this study are discussed.

Chapter Five

This chapter contains the empirical results and is divided into two sections. The first section is related to the analysis of the least-squares regression results, and the Cochrane-Orcutt technique results of the model. The second section carries out the causality test.

Chapter Six

The last chapter of this study presents policy implications and conclusions. In this chapter, recommendations according to the study findings are given along with the final conclusion.

CHAPTER II

THE BACKGROUND AND STRUCTURE OF THE SAUDI ARABIAN ECONOMY

Oil Exploration and Extraction in Saudi Arabia

The history of oil exploration and extraction in Saudi Arabia can be divided into three distinct periods.

The Period up to 1960: The Domination of International Companies and No Government Participation

Oil in the Kingdom of Saudi Arabia was exploited by a group of American oil companies known as the Arabian American Oil Company (ARAMCO). Shareholders of ARAMCO included Texaco (30%), Standard Oil of California (30%), Standard Oil of New Jersey (30%), and Mobil (10%). In 1933, ARAMCO (at that time called SOCAL) obtained a sixty-year--later changed to sixty-six year--concession over some 318,000 square miles of land, from the east coast through the eastern section of the country; the area comprised about 50% of the total land in the Kingdom. In return, the government of Saudi Arabia was to receive $0.22/bbl for oil extracted and taken from field storage, and a rent of 5,000 pounds sterling in gold per year from 1933 until oil was discovered. The contracts also included other financial arrangements, such as lending the government 30,000 pounds sterling in gold upon the signing of the contract, and an additional 20,000 pounds sterling eighteen months later. Both amounts were to be repaid out of the royalty payments once oil was discovered in commercial quantities. ARAMCO was to advance the

government of Saudi Arabia 50,000 pounds sterling and match that sum one year later. Another provision in the contract was to supply the government's oil requirements by giving, free of charge, 200,000 gallons of gasoline per year and 100,000 gallons of kerosene. Any disputes between the two parties were to be solved by a three-member group; one member from each side, and the third member to be chosen by the other two (Ghadar, 1977).

Oil was discovered in 1938 at Dhalhran and ARAMCO was granted additional territories of 120,000 square miles according to a new contract. This was in return for more revenue to the government than what had been specified in the first agreement. Production slowed down gradually because of the advent of World War II. Then, production was limited to 12,000 to 15,000 bbl/day during the war years.

In 1943, the United States became concerned about its own resource depletion and chose to allocate its supplies to ARAMCO for the building of a refinery at Ras Tanura, Saudi Arabia. This refinery, with a capacity of 50,000 bbl/day at the beginning, was completed by the end of 1945.

In 1948, the Trans-Arabian Pipeline (called the Tapline) from Saudi Arabia to Sidon, Lebanon, on the Mediterranean Sea, was under construction; and late in 1950, it was completed with an initial capacity of 32,000 bbl/day. In 1948, the concession contract with ARAMCO was under new negotiations. ARAMCO wanted offshore concession rights, and the Kingdom wanted some of the previous concession areas relinguished in return for granting ARAMCO offshore rights. ARAMCO agreed to give back to the government "the Kuwait-Saudi Arabia Neutral Zone," along with the greater part required by the government from the

previous concessions. Further negotiations took place in subsequent years, and more land was given back to the government. In 1975, ARAMCO's concession area was only 189,000 square kilometers, which was far less than the original concession area.

Additional royalty payments of $0.05/bbl for the potential oil supply offshore over the onshore payments was agreed upon. The minimum annual rent for the offshore area was $2 million/year; with $8 million to be paid in the event that no oil was discovered.

After World War II, a new era of competition between the international oil companies began. Some of the areas returned from the ARAMCO concession to the government were regranted to other international companies. In 1949, the government established a new concession with the Pacific Western Oil Company (later called Getty Oil). The sixty-year concession area covered an area of 5,000 square kilometers in the Neutral Zone, the area between Saudi Arabia and Kuwait (Ghadar, 1977).

The payment to the government was in terms of a royalty per barrel of oil, and also a share in the company's net profit. Getty had two fields in production, and it produced 80,200 bbl/day in 1974. Total estimated reserves for the two fields was 600 million bbl (some of the drilling for the company was carried out by the Arabian Drilling Company).

In 1950, Saudi Arabia completed negotiations with ARAMCO to include royalty payments as a part of the costs of production and began collecting income tax on the company's net profit. The tax was applied to the Getty Company as well.

In 1960, Saudi Arabia granted a concession to the Arabian Oil Company (Japanese). A forty-year agreement covered areas in the jointly-held Kuwait-Saudi Arabian Neutral Zone. Both governments, Saudi Arabia and Kuwait, received 10% interest each in the company, with Arabian Oil retaining 80%. However, by concession agreement, the government received 57% of the profits. In 1974, total output was 190,500 bbl/day, and total estimated oil reserves were 2.5 billion bbl.

These two additional concessions (Getty Oil Company and Arabian Oil Company) increased oil revenues to Saudi Arabia, but not up to the level of the government's desire. The government realized more than ever that the oil industry's policies, and the country's oil revenue, were controlled by the operating companies.

In 1956, when the Suez Canal was first closed, Saudi Arabia's crude oil production dropped from one million bbl/day to 665,000 bbl/day by January 1957. It rose again after the Suez Canal reopened in April of the same year. Saudi Arabia's revenue from oil had been affected adversely at that time, due to factors operating to drive the Middle East oil prices down, mainly the action of the United States in establishing oil import quotas, by imposing restrictions on oil imported from outside the United States. This meant that a large portion of the international oil market had been closed in the face of free trade and was lost for the time being. The American action adversely affected oil prices and drove them downward about 15% due to the decline of demand for crude oil while there was also a constant or increase (as in 1958 and 1959 because of new entries) in supplies. Many economists refer to the decline in oil prices as the major reason for the establishment of

the Organization of Petroleum Exporting Countries (OPEC) in August, 1960 (Ghadar, 1977).

Public Sector Operations

In 1962, Saudi Arabia established its own national oil company (Petromin) in an attempt to achieve the following goals: (a) developing a national industry through exploration, production, transportation, distribution, and marketing of petroleum and minerals; (b) entering the ventures of oil exploration, production, transportation, distribution, and marketing with other companies with full participation in their capital; and (c) importing any oil products or minerals as needed by the government (Ghadar, 1977).

Beginning in 1963, Petromin started a chain of negotiations with ARAMCO for the purchase of ARAMCO distribution facilities located in the Western Province, followed by other negotiations to include the other facilities located in the Central, Eastern, and Northern Provinces. In 1967, the negotiations were completed, and Petromin took over the marketing policies to become the sole distributor of oil for the whole country.

Besides its continuous expansion of its refining facilities, Petromin entered into joint ventures with many international companies in 1965 for the purpose of exploration and development in the northern area of the Red Sea coast. They had very favorable agreements, and the ventures were successful efforts in some areas.

Government Ownership

In 1973, the government of Saudi Arabia made its first step toward gaining control over its oil industry by purchasing a 25% interest in

ARAMCO's producing assets at a price of $500 million. According to the agreement, Saudi Arabia was to increase its participation share to 51% by 1982. In January 1974, Kuwait obtained a 60% interest in Kuwait's oil company (British Petroleum and Gulf), and in the same year, Saudi Arabia reached an agreement with ARAMCO allowing the Saudi government 60% participation in the company's producing assets. Then, in January 1975, an agreement was reached for 100% takeover of ARAMCO by the government of Saudi Arabia.

The Establishment of OPEC

In 1959, the United States government imposed mandatory import quotas on both crude oil and oil products in order to reduce dependence on foreign oil. The United States claimed that the purpose of the quota was to make the country self-sufficient. The world oil market was hurt very badly as a result of the action by the United States government. Many considered that event as the catalyst for the establishment of the Organization of Petroleum Exporting Countries (OPEC).

As a result of the decline in the demand for oil in the face of a constant supply (or, more accurately, an increasing supply of crude oil due to new entries int the oil industry and an improvement in the state of technology), oil prices were driven down. Consequently, revenues from crude oil products in the oil-exporting countries declined sharply. On September 10, 1960, representatives of six oil-producing countries (Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela) met in Baghdad, Iraq, and discussed the crises that oil-producing countries were facing at that time. They brought into being the Organization of Petroleum

Producing Countries (OPEC) as a permanent intergovernmental organization. Eight other countries joined the organization later (Qatar, 1961; Libya and Indonesia, 1962; United Arab Emirates, 1967; Algeria, 1969; Nigeria, 1971; and Ecuador and Gabon, 1973) (Johany, 1980).

The OPEC objectives were the coordination and unification of the petroleum policies among the members and the determination of the best means for safeguarding their interests, individually and collectively. At the same time, the organization would find ways of insuring stability of prices, eliminating harmful and unnecessary fluctuations.

Since the establishment of OPEC, prices have not fluctuated much, and it has had some control over price stability. In 1962-63, OPEC began negotiations with the international oil companies, individually, to change the treatment of royalties from an income tax to an expense. The government revenue per barrel was calculated, starting in 1964, as follows: royalties + 10% (of receipts over and above costs - royalties), replacing the old profit-sharing agreements. The new agreements resulted in increasing the per barrel revenues to the oil-producing countries, and the companies were granted $0.05 per barrel marketing allowance off posted prices. Another chain of negotiations for the purpose of adjusting the fees and allowances between OPEC and international oil companies took place after that.

The oil-consuming countries blamed the organization itself as being responsible for the subsequent events during the price explosion period, as in 1973-74 (the time of the Arab-Israeli War and the result of the Arab oil embargo) Also, in 1978-79, during the Iranian Revolution, there was a related oil crisis. In reality, the initial upsurge of prices mainly reflected the understandable fear of importers that the

crisis might reduce world crude supplies sharply for a significant period, but that did not happen. In 1979, production of oil increased by some oil-producing countries such as Saudi Arabia, and the absolute increase in current dollar per barrel price was much larger than in 1973. This further aggrevated the world balance-of-payments problem (e.g., Saudi Arabian surplus) (Moliver and Abbondante, 1980).

The price explosion was initiated in the open market or spot prices, and OPEC spokesmen explained the increases simply in terms of catching up with the open market or spot prices. In 1973, the spokesman of OPEC was the late Shah, and he justified a further increase in terms of alternative energies.

Description of Some Macroecomonic Variables in Saudi Arabia, 1963-83

Income Money Supply, and Price Level

Gross Domestic Product (GDP) and Gross National Product (GNP).

During the period under consideration, there have been great structural changes in the economy of the Kingdom of Saudi Arabia. For the purposes of comparison, the twenty-year period in this study has been divided into two parts; the first part covering the years before the oil price increase in 1973, and the second part covering the years 1973-83, the years after the oil price increase.

During the period 1963-72, the nominal GDP on the average grew at a rate of 13% per annum, while in the period 1973-83, it increased at a dramatically rapid rate of 25% per annum. This, in fact, was due to the large increase in the amount of oil revenue received by the government, which reflected indirectly its impact on the domestic economic activity.

When we add or subtract the net factor payments abroad to or from the nominal Gross Domestic Product, we obtain the nominal Gross National Product (GNP). If we look at the net factor payments of the country, it appears that up to 1975, the Kingdom of Saudi Arabia had negative factor payments, the amounts paid abroad exceeding the amounts received. Since 1976, the net factor payments were positive, the amount of inflow exceeding the amount of outflow. This was due to the return on the large amount of balance of trade surplus invested abroad; even though employment of foreign workers in the country was much higher in this period than before. In 1983, the negative factor payment was due to the decline in oil revenue and the consequences reflected in the decline of investment abroad (Table 2.1).

Table 2.2 shows both the GDP and the GNP at current and constant prices. It shows, also, their rates of growth. The GNP grew at a rate of 13% per annum during the period 1964-72, while the rate of growth in the second period, 1972-83, was 27% per annum. The high rate of growth in the GNP was due to the boom in oil prices, starting in 1973, when the nominal GNP increased from a value of 20.59 billions Saudi Riyal (SR) in 1972 to a value of 536.90 billions SR in 1982. Regardless of the other implications, this positive correlation between the GNP and the oil revenue indicates the sensitivity of the size of national income to government revenue, because a large part of the GNP comes from the government's oil revenue.

The GDP of Saudi Arabia at 1975 prices increased at an annual average rate of 12% during the period 1967-72, from 55.91 billion SR in 1967 to 101.05 billion SR in 1972. In the next period, 1973-82, the

Table 2.1 Flow of money in and out of Saudi Arabia, 1963-83.

Year	Value of exports	Value of imports	Net factor payment abroad
1963	4.98	1.63	--
1964	5.53	1.57	-2.01
1965	6.29	1.95	-2.24
1966	7.27	2.26	-1.94
1967	7.65	3.54	-2.96
1968	8.59	4.39	-3.20
1969	9.09	4.85	-3.25
1970	10.30	4.99	-3.83
1971	15.19	5.21	-5.68
1972	19.86	6.30	-7.67
1973	30.01	8.27	-10.46
1974	85.68	15.29	-16.97
1975	114.46	27.26	-14.20
1976	120.28	42.86	0.87
1977	140.32	62.70	2.67
1978	140.76	91.51	1.78
1979	147.24	107.48	6.64
1980	258.49	132.35	4.75
1981	368.43	157.46	12.16
1982	354.92	187.75	1.82
1983	223.41	188.68	-32.51

Period	Average Rate of Growth	
1963-72	0.15	0.18
1973-83	0.21	0.36

Source: Compiled from International Financial Statistics 35(1982):390-91, 410-11; International Financial Statistics 36(1983):366-67, 279; and International Financial Statistics 37(1984):398-99, 408-09.

Table 2.2 Prices and income in the Saudi Arabian economy, 1963-83 (in billions of Saudi riyals)

Year	Consumer price index at 1975 prices	GDP at 1975 prices	GDP at current prices	GNP at current prices	GNP at 1975 prices
1963	42.70	36.89	8.67	--	--
1964	43.90	39.66	9.32	7.31	16.65
1965	44.10	44.25	10.40	8.17	18.53
1966	44.80	50.80	1.94	10.00	22.32
1967	45.70	55.91	13.14	10.43	22.82
1968	46.50	65.01	14.66	11.63	25.01
1969	48.10	69.99	15.98	12.73	26.47
1970	48.20	76.57	17.40	13.57	28.15
1971	50.30	87.60	22.92	17.24	34.27
1972	52.50	101.05	28.26	20.59	39.22
1973	61.20	120.99	40.55	30.09	49.17
1974	74.30	139.24	99.32	82.35	110.83
1975	100.00	139.60	139.60	125.40	125.40
1976	131.60	151.65	164.53	165.39	125.68
1977	146.50	174.56	205.06	207.72	141.79
1978	144.20	184.95	223.74	225.53	156.40
1979	147.00	197.31	249.54	256.18	174.27
1980	152.40	216.19	385.81	390.55	256.27
1981	156.10	233.31	520.59	525.94	336.93
1982	157.87	236.74	524.73	536.90	345.38
1983	159.46	186.99	414.45	381.94	245.67

Period	Average Rate of Growth				
1963-72	0.02	0.12	0.13		
1973-82	0.10	0.06	0.25		
1967-72				0.13	0.10
1973-83				0.27	0.17

Source: Compiled from International Financial Statistics 35(1982):390-91, 410-11; International Financial Statistics 36(1983):366-67, 279; International Financial Statistics 37(1984):398-99, 408-09, and SAMA's Annual Report, various issues, 1971-84.

average annual growth rate was 6% (Table 2.1). The Kingdom of Saudi Arabia had a large amount of export surplus during the period starting from 1975. The imports also increased at a high rate, indicating a high increase in the absorptive capacity of the economy.

From 1977 to 1979, there was the largest contribution to gross fixed capital formation ever in the history of the country; most of the new capital went to nonoil sectors and to heavy investment in the infrastructure. In addition, the GNP at the constant price (1975) increased in the same pattern as the GNP at current prices when the real GNP increased at a moderate rate of 10% per annum during the period 1964-72 (Table 2.2). It had a higher rate of growth of 17% per annum during the next period, 1973-83.

Money Supply and Its Components

Saudi Arabia is one of the most open economies in the world. So, the existence of a strong and diversified monetary system is fundamentally necessary for economic stability and for a manageable growth rate. There are two distinguishable periods in the history of monetary systems in the Kingdom of Saudi Arabia.

1) In the period prior to the establishment of the Saudi Arabian Monetary Agency (SAMA) in 1952, when several coins, mostly foreign, circulated in the country; e.g., the British gold soverign and the Indian rupee. In 1927, Saudi Arabian silver riyal was issued to replace most of the foreign coins which were in circulation. Later, Saudi gold soverigns were issued for circulation side by side with British gold soverigns, which were replaced gradually.

2) The second period began with the establishment of SAMA in 1952. This agency represents the central bank of the country. But, even with this position as the head of the monetary system, it cannot be said that it has had control over the quantity of money which circulating in Saudi Arabia. The changes in government expenditures have been the principle determinate of money supplies in the country.

M_1 = currency with the public + demand deposits .

M_1 consists of (a) currency in circulation (outside of banks); and (b) demand deposits with banks. Currency in circulation experienced a high expansion, especially since 1973 after the oil price increase. Table 2.2 shows the rate of growth in currency outside banks. In the first period, 1960-72, it grew at a rate of 12% per annum, while it grew at a higher rate of 28% per annum during the second period, 1973-83. This high rate was due to oil price increases and the subsequent development project taken by the government. Demand deposit component of the money supply increased at a rate greater than that of currency with the public, especially during the 1970s. Table 2.3 indicates that during the years 1973-83, it grew at a higher rate of 36% per annum.

M_1 (the narrow definition of money supply) grew at 11% per annum during the period 1960-72, and at 32% per annum during the second period, 1973-83.

M_2 (the broader definition of money supply) = M_1 + saving and time deposits + other quasi-monetary deposits (quasi-money). Some authors (Hutchinson, 1980) make a distinction between two other concepts of money in the following way:

M_2 = M_1 + saving and time deposits .

M_3 = M_2 + other quasi-monetary deposits .

Table 2.3 Stock of money and its components in the Saudi Arabian economy, 1960-83 (in billions of Saudi riyals)

Year	Currency outside banks	Demand deposits	M_1	Time deposits	Quasi-[1] money	M_2 = (M_1 + quasi-money)
1960	0.52	0.41	.93	.06	0.09	1.02
1961	0.59	0.38	.97	.10	0.13	1.10
1962	0.66	0.42	1.08	.11	0.14	1.22
1963	0.83	0.48	1.31	.14	0.17	1.48
1964	0.85	0.52	1.37	.20	0.23	1.60
1965	0.94	0.55	1.49	.25	0.29	1.78
1966	1.06	0.66	1.72	.36	0.40	2.12
1967	1.20	0.72	1.92	.43	0.50	2.42
1968	1.45	0.75	2.20	.55	0.60	2.80
1969	1.56	0.77	2.33	.59	0.64	2.97
1970	1.63	0.77	2.40	.70	0.74	3.14
1971	1.67	0.98	2.65	.90	0.94	3.59
1972	2.42	1.36	3.78	1.21	1.27	5.05
1973	3.05	2.23	5.28	1.42	1.52	6.80
1974	4.14	3.19	7.33	1.44	2.44	9.77
1975	6.68	7.50	14.18	3.60	3.13	17.31
1976	10.59	13.68	24.27	4.31	5.34	29.61
1977	16.25	22.16	38.41	5.85	7.15	45.56
1978	19.18	30.03	49.21	7.63	8.82	58.03
1979	23.71	31.00	54.71	9.38	11.28	65.99
1980	25.68	33.28	58.96	3.83	18.48	77.44
1981	29.49	43.49	72.98	21.93	30.01	102.99
1982	34.44	49.34	83.78	29.68	40.04	123.79
1983	35.42	50.07	85.49	28.40	45.54	131.03
Period			Average Rate of Growth			
1960-72	0.12	0.10	0.11	0.27	0.09	0.13
1973-83	0.28	0.36	0.32	0.38	0.41	0.34

Source: Compiled from International Financial Statistics 35(1982):390-91, 410-11; International Financial Statistics 36(1983):366-67, 279; International Financial Statistics 37(1984):398-99, 408-09, and SAMA's Annual Report, various issues, 1971-84.

[1]Time + saving deposits + other

Table 2.3 shows M_2 and its components. The other components of money supply, besides M_1, are time, savings, and other quasi-monetary deposits. They are listed under quasi-money. Other quasi-money deposits are mainly deposits against letters of credit and guarantees.

All the subcomponents of quasi-money registered an exceptionally strong growth, especially during the years from 1973 to 1983. They registered record rates of growth equal to 41% per annum while their rate of growth during the period 1960-72 was only 9% per annum. This increase in M_1 and M_2 was due to a higher rate of growth in governmental cash flow spending that was not fully offset by the higher private sector balance of payment deficits resulting from payments for imports of goods and services and increased capital outflow. The definition of government cash flow is total revenue - change in government deposits with SAMA.

Currency - deposit ratio of the people. Let

K = currency - deposit ratio of the people

C = currency with public

and

D = demand deposits .

Then

$$\text{currency - deposit ratio of the people} = \frac{\text{currency with public}}{\text{demand deposits}}$$

$$K = \frac{C}{D} . \qquad (2.1)$$

This ratio was increasing during the period from 1960 to 1970, with a decreasing rate. For the next period, from 1971 to 1983, the currency-deposit ratio was declining gradually year after year. It was

1.27 in 1960, and increased to a ratio of 2.12 in 1970, which was the highest ratio ever. It then started to decline and reached 0.70 in 1983. This was due to the gradual change and adjustment in public behavior. It could also be attributed to the growth in banking habits facilitated by the rapid expansion and spread of commercial bank branch networks in all regions of the country.

Reserves of Commercial Banks

After 1952, the year of the establishment of the Saudi Arabian Monetary Agency (SAMA), there was an expansion of commercial banking through the establishment of both local banks and branches of foreign banks. This commercial banking system has been influenced by foreign banking practices and the religious strictures in Saudi Arabia, which restrict modern banking practices to some extent (e.g., interest paying or receiving is prohibited according to Islamic teachings).

The decree of June 11, 1966, provided the legal framework within which commercial banks have been operating in the Kingdom of Saudi Arabia. The right of monetary control was given to SAMA through the enumerations of certain procedures that should be followed by all commercial banks, and also by the requirement that all commercial banks must have a minimum liquid reserve deposit ratio equal to 15%. The right of SAMA to raise this reserve deposit ratio according to the economic conditions up to 20% was accorded. The liquid reserve might include cash, gold, and thirty-day credit instruments. The minimum reserve requirement was to control excess liquidity and to avoid inflationary pressures. Besides the reserve requirements on commercial banks, it is illegal for any commercial bank to give a single loan or

credit in excess of 25% of their reserve and paid-up capital. This regulation tended to discourage the commercial banks from making industrial loans (El Mallakh, 1982b).

Table 2.4 shows the absolute amounts of reserves in billion of Saudi Riyal during the period 1960-83. It increased at a high rate, especially during the years starting from 1972. In 1960, the amount of reserve was 0.11 billion. It grew rapidly to reach 22.12 billion in 1978. The amount of reserve then declined to reach an amount of 8.26 billion in 1983. This decline may be attributed to the substantial decline in real estate speculation and the increase in funds employed abroad by the private sector.

Reserve - deposit ratio of banks. Let

R = banks' reserve

r = reserve-deposit ratio of banks

D = demand deposits to commercial banks

T = time deposits in commercial banks

$$R = r(D + t \cdot D)$$

$$= r(1 + t)D ,$$

where

t = time-demand deposit ratio of banks $= \frac{T}{D}$

$$T = t \cdot D$$

$$r = \frac{R}{D + T} . \qquad (2.2)$$

In practice, commercial banks are more flexible as Table 2.4 shows that most of the time the actual reserves exceed the minimum reserve requirements. This phenomenon may be attributed, at least partially, to the lack of investment channels that can absorb effectively the highly

Table 2.4 Base money components in the Saudi Arabian economy, 1960-83 (in billions of Saudi riyals)

Year	Currency outside banks (C)	Banks reserve (R)	Base money B = C + R
1960	0.52	0.11	0.63
1961	0.59	0.11	0.70
1962	0.66	0.13	0.79
1963	0.83	0.17	1.00
1964	0.85	0.17	1.02
1965	0.94	0.19	1.13
1966	1.06	0.21	1.27
1967	1.20	0.23	1.43
1968	1.45	0.22	1.67
1969	1.56	0.23	1.79
1970	1.63	0.22	1.85
1971	1.67	0.23	2.20
1972	2.42	0.46	2.88
1973	3.05	1.23	4.28
1974	4.14	1.61	5.75
1975	6.68	4.85	11.53
1976	10.59	7.11	17.70
1977	16.25	13.03	29.28
1978	19.18	22.12	41.30
1979	23.71	13.59	37.30
1980	25.68	8.19	33.87
1981	29.49	8.27	37.76
1982	34.44	10.81	45.25
1983	35.42	8.26	43.68
Period	Average Rate of Growth		
1962-72	0.12	0.9	0.12
1973-83	0.28	0.19	0.25

Source: Compiled from International Financial Statistics 35(1982):390-91, 410-11; International Financial Statistics 36(1983):366-67, 279; and International Financial Statistics 37(1984):398-99, 408-09.

increasing income, and could be attributed also to the type of investments that most people engage in (e.g., real estate speculation).

Base money and money multiplier. Let

B = base money

C = currency

R = reserves of bank, and

$$B = C + R,$$

where

$$C = K \cdot D \text{ (see equation 2.1)}$$

and

$$R = r(1 + t)D ,$$

then

$$B = K \cdot D + r(1 + t)D$$

$$= [k + r(1 + t)]D . \qquad (2.3)$$

Base money in the Saudi economy has increased over the years. It increased from 0.63 billion SR in 1960 to reach an amount equal to 2.88 billion SR in 1972. It increased rapidly in subsequent years to become 43.68 billion SR in 1983. This rapid growth was due to the increase in revenue inflow from oil exports (Table 2.4).

Money multiplier.

$$B = [k + r(1 + t)]D$$

$$D = \frac{1}{K + r(1 + t)} \cdot B$$

$$\text{Money supply} = M^S = KD + \frac{1}{K + r(1 + t)} \cdot B$$

$$M^S = \left\{\frac{k}{K + r(1 + t)} + \frac{1}{K + r(1 + t)}\right\} \cdot B$$

$$M^S = \frac{1 + k}{K + r(1 + t)} \cdot B$$

M^S = Money multiplier x base money

= m x B

$$\text{Money multiplier} = \frac{1 + K}{K + r(1 + t)} \qquad (2.4)$$

The money supply is the product of the monetary base and the money multiplier. The growth of money supplies, then, comes from these two sources. Table 2.5 shows that the money multiplier in the Saudi economy did not have large fluctuations for the period, 1960-81, where it was above 1 and below 2, implying that in spite of the large amount of oil revenue received by the government during that period, the monetary authority followed a consistent and stable policy to keep the pressure of inflation under control.

The other source for money supply growth is base money, which, in fact, increased rapidly during the years 1972-78, from 2.88 billion SR in 1972 to 41.30 billion SR in 1978. This was due to the large number of development projects implemented in the country during those years. However, the government realized the consequences of injecting additional money on domestic inflation. Base money declined from 41.30 billion SR in 1978 to 33.87 in 1980 and then rose again to 43.68 billion riyals in 1983.

Price level. Table 2.1 shows the increase in the consumer price index for the years 1963-83. The rate of inflation during the years 1963-72 was relatively small. It was only an average of 2% per annum, while in the second period, 1973 to 1983, it increased to an average of 10%, mainly due to various factors, national and international.

Table 2.5 The components of money multiplier in the Saudi Arabian economy, 1960-83.

Year	k $\frac{C}{D}$	r $\frac{R}{D+T}$	t $\frac{T}{D}$	Money multiplier $m = \frac{1 + k}{k+r(1+t)}$
1960	1.27	.23	.15	1.48
1961	1.55	.23	.26	1.39
1962	1.57	.25	.26	1.36
1963	1.73	.27	.29	1.31
1964	1.63	.24	.38	1.34
1965	1.71	.24	.45	1.32
1966	1.61	.21	.55	1.35
1967	1.67	.20	.60	1.34
1968	1.93	.17	.73	1.32
1969	2.03	.17	.77	1.30
1970	2.12	.15	.91	1.29
1971	1.70	.28	.92	1.21
1972	1.78	.18	.89	1.31
1973	1.37	.34	.64	1.23
1974	1.30	.31	.61	1.28
1975	0.89	.46	.42	1.23
1976	0.77	.40	.32	1.36
1977	0.73	.47	.26	1.31
1978	0.64	.59	.25	1.19
1979	0.76	.34	.30	1.47
1980	0.77	.18	.42	1.72
1981	0.68	.13	.50	1.92
1982	0.70	.14	.60	1.84
1983	0.74	.12	.59	1.87

Source: Compiled from International Financial Statistics 35(1982):390-91, 410-11; International Financial Statistics 36(1983):366-67, 279; and International Financial Statistics 37(1984):398-99, 408-09.

Government Revenue and Expenditures

Saudi Arabia has a unique economic system, as it is a one-commodity net producer and exporter. Economic activities are dependent on, and sensitive to, what happens to oil prices on the world market. The country is striving to explore and develop other alternative resources in order to diversify the basket of resources, and to minimize the risk associated with one commodity as the only source of economic activity.

Table 2.6 shows the revenue estimation from all resources and the prediction by the financial authority that extra funds from the reserve may be needed to finance total expenditures.

Source of revenue. The rapid growth in the government revenue, as well as the growth in the national income, is dominated by a single commodity revenue; that is the petroleum products revenue. Revenue from oil products grew with increasing rates year after year from 1,928 million SR in 1962-63 to 9,855 million SR in 1971-72, giving a moderate rate of growth of 16% per annum. From 1972-73, the revenue from oil rose from 12.098 million SR to an estimated value of 270,579 million SR in 1982-83, which means a higher rate of growth than before, equal to 32% per annum.

Before 1975, the year of 100% ownership of oil industries by the government, the revenue from the oil sector consisted of (a) oil royalties from the operating companies; (b) income tax collected from the companies; (c) tapline fees; and (d) payments received by the government in respect of the 60% participation interest in ARAMCO;s producing assets starting in 1974. In January 1975, an agreement in principle has been reached for 100% takeover of ARAMCO by the government of Saudi Arabia (Ghadar, 1977).

Table 2.6 Estimated annual revenues and expenditures in the Saudi Arabian economy, 1962-83 (in billions of Saudi riyals).

Year	Oil revenues	Nonoil revenue: Other revenues	Nonoil revenue: From reserve	Total revenue = Total expenditures
1962-63	1,928	338	186	2,452
1963-64	2,268	358	62	2,686
1964-65	2,592	370	150	3,112
1965-66	3,166	448	347	3,961
1966-67	3,974	476	575	5,025
1967-68	3,547	518	872	4,937
1968-69	4,196	703	636	5,535
1969-70	5,198	768	--	5,966
1970-71	5,346	944	--	6,380
1971-72	9,855	927	--	10,782
1972-73	12,098	1,102	--	13,200
1973-74	21,110	1,750	--	22,810
1974-75	94,432	3,815	--	98,247
1975-76	86,969	8,878	15,088	110,935
1976-77	99,507	11,428	--	110,938
1977-78	113,154	15,339	--	146,493
1978-79	116,534	13,466	--	130,000
1979-80	156,406	3,994	--	160,000
1980-81	257,004	4,512	--	261,516
1981-82	333,968	6,032	--	340,000
1982-83	270,579	42,821	--	313,400

Period	Rate of Growth		
1962-63/ 1971-72	0.16	0.14	0.15
1971-72/ 1979-80	0.32	0.22	0.24

Source: Compiled from SAMA's Annual Reports, various issues, 1971-84.

The relative share of nonoil sources in the government revenue remained insignificant over many years and is declining as a percentage of the total revenue. Table 2.6 shows that the share of nonoil revenue does not represent more than 15% of the total revenue in any past year. In addition, during the last ten years, nonoil revenue declined more to represent only approximately 10% of total revenues, except in 1983, which was approximately 13%. The decline of nonoil revenue share in total revenue does not imply its decrease in magnitude and absolute value. Nonoil revenue increased at a rate of 37% per annum during the period 1973-83.

Most nonoil revenue comes from the agricultural sector (which had a declining share in the GDP during the last ten years), taxes and fees from foreign businesses, communications, manufacturing, and mineral resources.

Government expenditures increased rapidly during the last ten years. Table 2.6 shows a positive relationship between revenue from oil products and total expenditures. Both grew almost at the same rate. During the period 1962-72, the total estimated expenditures rose at a rate of 15% per annum, from 2,452 million SR to 10,782 million SR. During 1973-83, expenditures rose from 13,200 million SR, to reach 313,400 million with an annual rate of growth of 24%.

It is worth mentioning that actual revenue and expenditures were far greater than the estimation in Table 2.6 (e.g., during 1971-75 actual expenditures were 89.2% greater than the estimated expenditures). This was due to a higher revenue from oil products than was expected.

Government expenditures are the major channel through which oil revenues can be injected into the economy. The following are the most

dominant channels of expenditures in Saudi Arabia: (a) agriculture and water resources development; (b) transports and communication; (c) human resources and welfare; (d) infrastructure; and (e) defense and administration expenditures. The government decided to let the productive sector (except petroleum-based industries) be dominated by the private sector.

Relations Between Government Budget and Money Supply

The monetary system in the Kingdom of Saudi Arabia differs from the modern monetary system because there are some restrictions on what has been considered the cornerstone of the capitalist system (i.e., interest principle). In Saudi Arabia, changes in government expenditures have been the primary determinate of the money supply. No clear differences between monetary and fiscal policies exist. Any increase in the government expenditures have been met mainly by drawing on its reserve with SAMA. The question now is how the government increases the quantity of money.

This question can be answered as follows. First, any increase in oil revenue or in the balance of trade surplus of the Kingdom does not lead to an increase in the money supply directly. Second, government expenditures are the major determinate of the change in money supply. When the government spending increases (G), this implies that the monetary base (B) increases also[1]. At the same time, this implies that there is a multiplier effect since the money supply will not increase

[1]We assume no sterilization policy.

one to one with the change in base money. To calculate any changes in money supply, equation 2.4 can be used.

$$M^S = \frac{1 + K}{K + r(1 + t)} \cdot B \,, \tag{2.5}$$

where the changes in the money supply = the multiplier (m) x changes in base money (B).

Government budgetary policies determine the size of base money, the behavior of commercial banks, and the composition of the portfolio for the general public. The change in base money determines the effect on money supplies. Reserve requirements can be used as an effective tool to achieve specific monetary goals, especially if the actual reserve ratio do not exceed the minimum reserve requirement.

Al-Bashir (1977) shows econometrically a positive relationship between changes in government expenditures and money supply. Let

M^S = money supply

B = monetary base

GNP = economic activity

U = error term

$$M^S = \alpha_o + \alpha_1 B + \alpha_2 GNP + U \tag{2.6}$$

Throughout his study, he shows the regression results which confirm a positive correlation between the money supply, monetary base, and the level of economic activity, implying without doubt, the influence of economic activity over the quantity of money; in other words, a dominant role of the government expenditures in money supply determination. Al-Bashir obtained the following regression results:

$$M_1 = -98.657 - 1.028B + 0.054\ GNP \qquad R^2$$
$$(0.215) \quad (0.027) \qquad .99$$

$$M_2 = -341.730 + 0.605B + 0.164\ GNP$$
$$(0.274) \quad (0.034) \qquad .99$$

$$\ln M_1 = -0.840 + 0.731\ \ln B + 0.355\ \ln GNP$$
$$(0.133) \quad (0.128) \qquad .99$$

$$\ln M_2 = -2.342 + 0.592\ \ln B + 0.621\ \ln GNP$$
$$(0.133) \quad (0.128) \qquad .99$$

Foreign Trade Sector

A glance at exports and imports of Saudi Arabia from 1963 to 1983 reveals some important facts about Saudi Arabian foreign trade, and makes it clear why foreign trade has been considered the backbone of the economy. The total foreign trade of the Kingdom increased from an annual average of 13.87 billion SR in 1964-72, to 227.87 billion SR in 1973-81, which represented a growth rate of more than 642% in annual average total trade.

Exports

Saudi Arabia is a net exporter country. It exports a large share of its Gross National Product to the outside world. More than 80% of its GNP is exported in the form of petroleum products. Table 2.7 gives a clear idea about the historical progress in Saudi Arabia petroleum exports, and its accelerating rate of increase over time.

Table 2.7 The annual value of petroleum exports and their annual average rate of growth in the Saudi Arabian economy, 1964-83 (in billions of Saudi riyals).

Year	Value of petroleum exports*
1964	4.88
1965	5.64
1966	6.72
1967	7.20
1968	8.00
1969	8.77
1970	9.89
1971	14.92
1972	18.84
1973	28.93
1974	110.54
1975	104.54
1976	136.91
1977	154.98
1978	128.56
1979	197.12
1980	339.37
1981	383.00
1982	261.33
1983	165.18

Period	Average rate of growth
1964-72	0.17
1973-81	0.18

Source: Compiled from International Financial Statistics, various issues, 1982-84.

The entire period 1964-83 is subdivided into two parts, from 1964 to 1972 and from 1973 to 1983. In the first period (1964-72), there was a moderate rate of growth in petroleum exports compared to the second period, 1973-83. From 1964-72, the annual average rate of growth was 17%. It started with an annual average of petroleum exports of 4.88 billion SR in 1964 and reached the value of 18.84 billion SR in 1972.

The rate of growth of petroleum exports during the next period was higher than in the first period. The petroleum exports values increased from 28.93 billion SR in 1973 to 165.18 billion SR in 1983, representing an annual rate of growth of more than 18%. A comparison of the petroleum exports with total exports of the country indicates that petroleum exports represent around 95% of the annual average total exports in the period, 1964-72, when the annual average petroleum export was 9.43 billion SR out of total exports of 9.97 billion SR. In the second period, 1973-83, petroleum exports represent an average of almost 100% of total exports, which implies that petroleum products are the major exporting commodity of the Kingdom. The value of exports represents more than 80% of the GNP in the first period, 1964-72, and represents approximately 70% of the GNP during the second period, 1973-83.

Imports

The import sector represents a small part of the Saudi Arabian total trade compared to the exporting sector. This is related to the size of Saudi trade and other internal variables such as local production and population size. But, when it comes to dollar figures, and the total amount of money outflow from the country to the outside

world, the import sector becomes important in the sense that a large amount of Saudi revenue has been spent on imported commodities and capital assets.

During the first period, from 1964 to 1972, the average annual value of imports was 3.9 billion SR, which represents more than 30% of the average Saudi Arabian GNP of the same period. The average value of imports for the second period, 1973-83, was 71.69 billion SR, representing more than 32% of the average Saudi Arabian GNP of the same period.

It is clear that a sharp increase in Saudi Arabian imports began after 1973, and it was related, for the most part, to the large amount of oil revenue inflow to the government's treasury. Regarding the actual composition of imported goods, the leading market has been in machinery, transportation equipment, and electrical appliances. The second largest category is miscellaneous, building materials, and food stuffs.

Trade Surplus

Saudi Arabia is one of the most powerful economic forces in the world. As the world's third largest oil producer, endowed with more than one-fourth of the world's proven oil reserve, it is the world's leading exporter of crude oil, commanding a primary position in the international economy. Table 2.8 shows the balance of trade of Saudi Arabia. During the period from 1963-81, the country did not experience any balance of trade deficit.

Table 2.8 Saudi Arabia's balance of trade, 1963-83 (in billions of US dollars)

Year	**1963**	**1964**	**1965**	**1966**	**1967**	**1968**
Balance of trade	0.69	0.69	0.75	0.91	1.02	1.21
Year	**1969**	**1970**	**1971**	**1972**	**1973**	**1974**
Balance of trade	1.20	1.49	2.51	3.42	5.87	28.36
Year	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**
Balance of trade	25.62	30.21	29.41	17.57	34.49	71.95
Year	**1981**	**1982**	**1983**			
Balance of trade	78.05					

Source: International Financial Statistics (1983), pp. 40-41.

Direction of Trade

The Saudi Arabian foreign trade relationship changed somewhat in its magnitude and direction in the 1970s. The major top ten trade partners in Saudi Arabian foreign trade are Japan, the United States, France, Italy, United Kingdom, Germany, Netherlands, Spain, Belgium, and Singapore.

Western Europe has been the primary recipient of Saudi exports, receiving more than one-half of the top ten trading partners' share in Saudi Arabian foreign trade. During 1963-67, Western Europe's share among the top ten trade partners in Saudi Arabian exports represent about 52%. Western Europe exports to Saudi Arabia for the same period represents 40% of total exports by the top ten trading partners to Saudi Arabia (30% of Saudi Arabia's total imports) (Table 2.9). Saudi Arabia imports from Western Europe constitute machineries, construction

Table 2.9 The top ten partners in Saudi Arabian trade, 1963-67 (in millions of U.S. dollars).

	Exports		Imports		Total trade	
Trade with	Value in millions of US $	% share	Value in millions of US $	% share	Value in millions of US $	% share
Japan	349.08	0.3215	54.74	0.1579	403.82	0.2819
United States	84.70	0.0780	136.90	0.3949	221.60	0.1547
Italy	176.48	0.1629	24.62	0.0710	201.10	0.1404
Germany	123.76	0.1140	38.62	0.1114	162.38	0.1134
United Kingdom	78.06	0.0719	45.06	0.1300	123.12	0.0629
Spain	89.62	0.0825	0.44	0.0013	90.06	0.0629
Netherlands	51.26	0.0472	17.92	0.0517	69.18	0.0483
Australia	53.12	0.0489	10.54	0.0304	63.66	0.0444
France	47.20	0.0435	13.52	0.0390	60.72	0.0424
Canada	32.44	0.0299	4.28	0.0123	36.72	0.0256
Total	$1,085.72	1.00	$346.64	1.00	$1,432.36	1.00

Average five-year exports: $1,355.84
Average five-year imports: 472.50
Average total trade: 1,828.34

Source: Compiled from Direction of Trade Annual 5(1963-67):306-307.

materials, and furniture. The same pattern followed during the period 1968-72. Table 2.9 shows that the share of Western Europe in Saudi Arabia's total exports was 50% while Saudi Arabia imports from these countries was 32%.

Tables 2.10, 2.11, and 2.12 show that exports to these countries declined even more, to 45%, 36%, and 33%, respectively. The discovery of oil in the North Sea and conservation measures in energy consumption are some of the reasons for the declining trend.

Japan and the United States represent the most important individual countries in Saudi Arabian foreign trade. Japan is the largest trade partner country ever in Saudi Arabian foreign trade, especially its imports of oil. From 1963 to 1967, Japan's share among the top ten partners in Saudi trade was more than 32% (26% of Saudi Arabia's total exports). Its exports to Saudi Arabia were 16% among the top ten partners (12% of total Saudi imports), mainly electronic equipment and automobiles.

During the period from 1967 to 1972, Japan's share of Saudi exports among the top ten partners declined to 26% (19% of total Saudi exports); while its exports to Saudi Arabia increased to approximately 21%, equivalent to 14% of total Saudi imports. From 1972 to 1973, Japan's share of Saudi exports declined even more to less than 25% (17% of Saudi exports); and its exports to Saudi Arabia increased to more than 27% (16% of Saudi Arabia's total imports). However, from 1976 to 1978, Japan's average imports from Saudi Arabia rose again to 30% of the top ten trade partners' share (20% of total Saudi Arabian exports). Japan's exports to Saudi Arabia fell to less than 21% or to 14% of Saudi Arabia's total imports at that time. During 1979-83, Japan kept its

Table 2.10 The top ten partners in Saudi Arabian trade, 1968-72 (in millions of U.S. dollars).

	Exports		Imports		Total trade	
Trade with	Value in millions of US $	% share	Value in millions of US $	% share	Value in millions of US $	% share
Japan	595.39	0.2566	120.19	0.2086	715.58	0.2470
Italy	313.37	0.1350	40.61	0.0705	353.98	0.1222
United Kingdom	254.20	0.1095	75.75	0.1315	329.95	0.1139
Netherlands	279.10	0.1203	32.87	0.0570	311.97	0.1077
France	232.10	0.1000	32.12	0.0557	264.23	0.0912
United States	81.85	0.0353	181.22	0.3145	263.07	0.0908
Germany	179.36	0.0773	63.67	0.1105	243.03	0.0839
Spain	171.59	0.0739	1.77	0.0031	173.36	0.0598
Bahrain	115.83	0.0499	10.04	0.0174	125.87	0.0435
Belgium	97.71	0.0421	18.02	0.0313	115.73	0.0400
Total	$2,320.50	1.00	$576.26	1.00	$2,896.77	1.00

Average five-year exports: $3,065.63
Average five-year imports: 830.34
Average total trade: 3,895.97

Source: Compiled from Direction of Trade Annual 5(1968-72):236-237.

Table 2.11 The top ten partners in Saudi Arabian trade, 1973-75 (in millions of U.S. dollars).

	Exports		Imports		Total trade	
Trade with .	Value in millions of US $	% share	Value in millions of US $	% share	Value in millions of US $	% share
Japan	3,875.00	0.2474	468.67	0.2702	4,343.67	0.2507
France	2,448.33	0.1571	62.67	0.0361	2,511.00	0.1449
Italy	2,040.00	0.1309	98.67	0.0569	2,138.67	0.1235
United Kingdom	1,736.00	0.1114	202.00	0.1165	1,938.00	0.1119
United States	869.00	0.0557	530.33	0.3058	1,399.33	0.0808
Spain	1,279.00	0.0820	5.67	0.0033	1,284.67	0.0742
Netherlands	983.33	0.0631	102.00	0.0588	1,085.33	0.0627
Germany	869.00	0.0518	195.33	0.1126	1,064.33	0.0614
Brazil	808.00	0.0518	1.67	0.0010	809.67	0.0467
Belgium	681.33	0.0437	67.33	0.0388	748.67	0.0432
Total	$15,588.49	1.00	$1,734.34	1.00	$17,322.34	1.00

Average three-year exports: $22,328.33
Average three-year imports: 3,016.33
Average total trade: 25,344.66

Source: Compiled from Direction of Trade Statistics Yearbook (1979): 234-235.

Table 2.12 The top ten partners in Saudi Arabian trade, 1976-78 (in millions of U.S. dollars).

	Exports		Imports		Total trade	
Trade with	Value in millions of US $	% share	Value in millions of US $	% share	Value in millions of US $	% share
Japan	7,619.33	0.2975	2,122.67	0.2068	9,742.00	0.2650
United States	3,658.00	0.1380	3,054.33	0.2975	6,712.33	0.1826
France	3,953.00	0.1492	562.67	0.0548	4,515.67	0.1228
Italy	2,501.67	0.0944	979.67	0.0954	3,481.33	0.0947
United Kingdom	1,661.00	0.0627	1,026.33	0.1000	2,687.33	0.0731
Germany	1,238.00	0.0467	1,410.33	0.1374	2,648.33	0.0720
Netherlands	1,806.67	0.0682	576.67	0.0562	2,383.33	0.0648
Spain	1,499.33	0.0566	106.33	0.0104	1,605.66	0.0437
Belgium	1,212.00	0.0457	301.00	0.0293	1,513.00	0.0412
Singapore	1,351.67	0.0510	126.00	0.0123	1,477.67	0.0402
Total	$26,500.67	1.00	$10,266.00	1.00	$36,766.65	1.00

Average three-year exports: $38,071.67
Average three-year imports: 15,136.33
Average total trade: 53,208.00

Source: Compiled from Direction of Trade Statistics Yearbook (1979): 234-235.

imports from Saudi Arabia at the same level (30%) of the top ten trade partners, but it increased its exports to Saudi Arabia from 21% in 1978 to 25% in 1983.

In contrast, the United States has had a favorable balance of trade with Saudi Arabia over many years. During the period 1963-67, Saudi Arabia suffered balance of trade deficits with the United States. Its share in Saudi exports was less than 8% of the top ten trade partners share, while its share of exports to Saudi Arabia was more than 39% among the top ten. The United States imports oil from Saudi Arabia in exchange for machinery, defense equipment, food stuffs, and other items. From 1968 to 1972, the U.S. share among the top ten trading partners in Saudi exports was less than 4%, while its exports to the Kingdom were more than 31%.

During the next two periods, 1973-75 and 1976-78, total imports from Saudi Arabia by the United States rose, and the U.S. share in Saudi Arabian imports declined. During these two periods, the United States had, for the first time, a balance of trade deficit with the Kingdom of Saudi Arabia; but from 1979 to 1982, imported oil by the United States increased to 19% of the top ten partners' shares in Saudi Arabian's foreign trade while its export to Saudi Arabia declined for an average of 30% in the previous year to 27%, which represents more than 20% of the average for five years of total imports (Table 2.13). Table 2.13 also shows the percentage share of Japan, the United States, and Western Europe in Saudi Arabia's average total trade, and the percentage share of the top ten partners in Saudi Arabia's total trade. It also gives a clear idea about the declining trend which is due to new policies taken by these countries in the 1970s with the aim of reducing dependence on

Table 2.13 The top ten partners in Saudi Arabian trade, 1979-83 (in millions of U.S. dollars).

	Exports		Imports		Total trade	
Trade with	Value in millions of US $	% share	Value in millions of US $	% share	Value in millions of US $	% share
Japan	15,916	0.2977	6,243	0.2483	22,159	0.2819
United States	10,106.2	0.1890	6,903.4	0.2746	17,009.6	0.2164
Germany	2,840.2	0.0531	3,393.6	0.1351	6,238.8	0.0793
United Kingdom	2,566.8	0.0480	2,192.8	0.0872	4,759.6	0.0605
France	7,034.2	0.1315	1,806.8	0.0718	8,841	0.1124
Italy	5,108.2	0.0955	2,376.6	0.0945	7,484.8	0.0952
Netherlands	4,087.4	0.0764	933.8	0.0371	5,021.2	0.0638
Belgium	2,243.6	0.0419	540.8	0.0215	2,784.4	0.0354
Spain	2,463	0.0460	551	0.0219	3,014	0.0383
Canada	1,094.8	0.0204	192.8	0.0076	1,287.6	0.0163
Total	$53,460.4	1.00	$25,139.6	1.00	$87,600.0	1.00

Average five-year exports: $ 80,397.2
Average five-year imports: 33,894.2
Average total trade: 114,291.4

Source: Compiled from Direction of Trade Statistics Yearbook (1984): 328-330.

Saudi oil and following a wave of conserving energy and finding other alternatives.

Foreign Assets and Foreign Exchange Reserves

The flow of foreign assets to the Kingdom of Saudi Arabia increased dramatically, especially after 1973. The foreign asset flow can be divided into two parts, according to its purpose.

Foreign Assets Deposited at the Saudi Arabian Monetary Agency (SAMA)

This part of foreign assets represents a large share of foreign assets flowing into the country. It increased from 2.68 billion SR in 1964 to 11.99 billion SR n 1972, representing a rate of growth of 15% per annum. In 1983, the foreign assets deposited at SAMA were 463.49 billion SR, which represents an average rate of growth equal to 33% per annum.

Foreign Assets Deposited at Commercial Banks

The commercial banks have received a lesser amount of foreign assets. They received only 0.26 billion SR in 1964, but the assets increased at a rate of 23% per annum to reach 1.33 billion SR in 1972. During the next period, 1973-83, the foreign assets in commercial banks rose at a rate of 50% per annum to reach 53.36 billion SR in 1981 and 62.38 in 1983.

Foreign Exchange Reserve

Since Saudi Arabia is an economically powerful country, this country has consistently accumulated huge amounts of foreign reserves

above the level needed to finance expanded imports and to enable the Saudian Monetary Agency (SAMA) to keep the value of the Saudi Riyal stable.

Saudi Arabia's foreign exchange reserves rose from 2.22 billion SR in 1964 to an amount of 9.73 billion of SR in 1972, giving a rate of growth of 13% per annum. During the period from 1973-83, Saudi foreign exchange reserves rose gradually to reach an amount of 95.93 billions SR in 1977. However, in 1978, reserves declined to the amount of 56.88 billion of SR. They then increased again to reach 60.31 billion SR in 1981, representing a growth rate of growth for 1973-83 of 14% increase per annum (Table 2.14).

Foreign Exchange Rate

The Saudi Arabian riyal is the unit of exchange, and it was fixed at SR 4.50 per U.S. dollar in 1960. Due to the successful stabilization program undertaken by the financial authorities, it helped to maintain equilibrium in internal and external monetary arrangements.

In 1971, the Saudi riyal started becoming more expensive in terms of the U.S. dollar, since instead of an exchange rate of 4.50 SR for one dollar, it became 4.47 SR per dollar. The riyal continued to become even stronger. In 1980, it reached its highest value in terms of U.S. dollars, where the exchange rate became 3.33/$1 and 3.38/$1 in 1981. It rose again to reach 3.4547/$1 in 1983 (Table 2.14).

The Saudi Arabian riyal can be affected through the changes in the U.S. dollar exchange rate in the world market besides the oil market. If the oil market is booming, the riyal becomes stronger, and it also becomes stronger in terms of exchange with other currencies. The nature

Table 2.14 Foreign assets and foreign exchange reserves in Saudi Arabian economy (in billions of Saudi riyals).

Year	Foreign exchange rate riyal/US$	Foreign assets in billions of S/riyals at SAMA	at Comm/bank	Total	Foreign exchange reserve
1964	4.500	2.68	0.26	2.94	2.22
1965	4.500	3.40	0.19	3.59	2.86
1966	4.500	3.66	0.18	3.84	2.95
1967	4.500	4.25	0.23	4.48	3.02
1968	4.500	3.92	0.27	4.19	2.34
1969	4.500	3.53	0.36	3.89	2.09
1970	4.500	4.02	0.45	4.47	2.34
1971	4.4868	6.95	0.64	7.59	5.79
1972	4.1448	11.99	1.33	13.32	9.73
1973	3.7014	16.99	1.37	18.36	13.72
1974	3.5500	78.19	1.63	79.82	47.66
1975	3.5176	136.54	3.62	140.16	75.12
1976	3.5300	180.84	8.29	189.13	86.40
1977	3.5251	208.27	11.28	219.55	95.93
1978	3.3996	198.95	11.55	210.50	56.88
1979	3.3608	207.46	18.19	225.65	58.40
1980	3.3267	290.75	32.23	322.98	69.02
1981	3.3826	439.88	53.36	493.24	94.71
1982	3.4274	484.22	61.00	545.22	81.62
1983	3.4547	463.49	62.38	525.87	60.31
Period		Average Rate of Growth			
1964-72		0.15	0.23	0.15	0.13
1973-83		0.33	0.50	0.31	0.14

Source: Compiled from International Financial Statistics, various issues, 1982-84.

of the oil commodity and its demand elasticity makes the Saudi riyal an expensive currency. At the same time, it accumulates more foreign reserves regardless of the other economic variables.

Inflation

Domestic Inflation

Inflation is one of the most disturbing economic phenomenon in any economy, developed or developing. It is more harmful in a growing economy like Saudi Arabia's because of the inadequacy and imbalance of existing capacities and organizational structures. The evidence shows the inflation rate in Saudi Arabia was contained to a manageable level, and the policies taken by the authorities were succeeded in maintaining the basic desired momentum and direction. This implies that the government was able to identify the causes of inflation and to introduce appropriate countermeasures.

Trends of Inflation

In an open economy like Saudi Arabia, world economic conditions have a direct effect and great influence on the stability of the internal economy. Table 2.1 contains some information about inflation in Saudi Arabia. First, until 1972, price levels in Saudi Arabia were more or less stable and the rate of inflation did not exceed the average rate of 2% per annum.

Second, beginning with 1973, the economic condition changed and the Saudi economy became more dependent on oil revenues. This exposed the economy to sudden changes in its basic structure due to large increases in oil prices and the consequences of more money inflow which, in turn, affected domestic prices.

Since 1973, the rate of inflation has reached an annual average of 10% per annum, which is almost the same as the average rate of inflation for the top ten trade partners of Saudi Arabia.

Third, it is true that the main cause of inflation in Saudi Arabia was the gap between government-financed demand on the one hand, and the required supply of goods, services, and labor on the other. This was aggravated by the inadequacies of an undeveloped and an inefficient infrastructure.

Fourth, from Table 2.2, one can see that inflation accelerated from 1972 "where prices peaked gradually" to 1977. After that period, prices decelerated and have almost been under control.

Monetary Policy and Inflation

Saudi Arabia fights inflation primarily through the adjustment of the most basic economic relationship (supply and demand). This was the only effective tool to slow down the inflation rate in the absence of any of the usual instruments of monetary policy and control. Also, fiscal policy tools of injecting more development projects to the economy make the role of monetary policy secondary through ensuring the efficient circulation of funds and by preventing the accumulation of idle funds for speculation.

Saudi Arabian domestic expenditures can be divided into two categories (a) payment of salaries; and (b) expenditure payments on projects inside the country. In fact, the transfer of funds to finance the budget project is considered the main aspect of monetary inflation because of the higher contract prices, which imply more money supply leading to higher inflationary pressures and expectations.

Imported Inflation

In Saudi Arabia, more than 80% of the GNP, in the form of oil products, are exported to the outside world and most of the basic needs are imported. So, the world rate of inflation is likely to have a large impact on the domestic rate. The annual average rate of inflation in Saudi Arabia is less than world inflation. From 1963 to 1972, the rate of inflation was 2% per annum, while the weighted average rate of inflation among the top ten trade partners of Saudi Arabia was 5% per annum for the same period. For the period from 1973 to 1983, the rate of inflation in Saudi Arabia was around 10% per annum, which was the same as the weighted average rate for the top ten trade partners.

CHAPTER III

REVIEW OF LITERATURE

Introduction

It is believed today that there exists a causal link between changes in international reserves and changes in world prices. Changes in global international reserves have a direct and indirect impact on the world money supply, and these changes in the world money supply in turn influence the worldwide rate of inflation.

This chapter is divided into four sections. The first section is concerned with the theories of balance of payments. The second section is related to foreign reserves and inflation. The third section discusses the relationship between the exchange rate system and inflation, and the final section is concerned with costs of inflation.

Review of Balance of Payment Theories

A systematic record of all economic transactions between the residents of the reporting country and the residents of foreign countries during a given period of time is called balance of payments (Lindert and Kindleberger, 1982). The main purpose of keeping these records is to give the governmental authorities a clear picture of the international position of specific countries and to guide them in reaching decisions on fiscal and monetary policy on the one hand and trade and payment problems on the other. The balance of payments is kept in standard double-entry bookkeeping under which each international

transaction undertaken by residents of a country results in a debit and a credit of equal size and it has three accounts:

1) Current account: It includes visible exports, invisible exports on the credit side, visible imports and invisible imports on the debit side; the difference is called the country's balance of trade.

2) Capital account: It contains loans and equity capital given by foreigners, repatriation of domestic capital by foreigners on the credit side, loans and equity capital given to foreigners, and repatriation of foreign capital on the debit side.

3) Monetary account/Accommodating entry/Entry below the line: The balance of payments has a deficit, or is balanced, and/or has a surplus accorded as a total credit. Accounts are less, equal, and greater than total debits accounts, respectively. When the balance of payments is balanced, there is no entry below the line. When there is a deficit in the balance of payments, any combination of the following entries should take place: (a) outflow of gold (monetary), (b) outflow of foreign exchange, (c) inflow of accommodating loan. But when there is a surplus in the balance of payments, any combination of the following entries should take place: (a) inflow of monetary gold, (b) inflow of foreign exchange, (c) grant of accommodating loan.

Now in the study of the balance of payments, there are simply two approaches.

Nonmonetary Approach

The nonmonetary approach deals with the first two accounts. This approach views the entry in the third account as a balancing entry or a residual entry, so this approach specifically deals with demand-supply

conditions in the commodity and capital markets and suggests policies to affect demand and supply in these markets.

Monetary Approach to the Balance of Payment

This approach deals with the third account where it brings into focus the demand for and supply of money within a country and suggests that any disequilibrium in the national money market produces a disequilibrium in the balance of payments. A disequilibrium in the money market is a stock disequilibrium. It is corrected through a stock adjustment principle, and the effort of the people to correct this stock disequilibrium in the money market generates a balance-of-payments disequilibrium. When the domestic supply of money exceeds the domestic demand for money ($M^s > M^d$), this case implies stock adjustment $\alpha(M^s - M^d)$. People will get rid of money to the extent of $\alpha(M^s - M^d)$ by buying more goods and services from abroad and/or buying more foreign bonds and equities. There will be a deficit in the BOP and foreign exchange reserve will decline. When the domestic demand for money exceeds the domestic supply of money ($M^d > M^s$), this implies the stock adjustment $\alpha(M^d - M^s)$, and people will get hold of money to the extent of $\alpha(M^d - M^s)$ by selling more goods and services abroad and/or selling more domestic bonds and equities to foreigners. They will receive foreign exchange which they will exchange for national money from the monetary authority. There will be a surplus in the balance of payment and foreign exchange reserve will increase (Johnson, 1976a).

Essence of monetary approach. The balance-of-payments problems are monetary problems in a world economic system and should be appropriately analyzed in terms of models that explicitly specify monetary behavior

and integrate it with the real economy rather than models that concentrate on real relationships and treat monetary behavior as a residual of real behavior. Money concerns a stock--not a flow--and monetary equilibrium and disequilibrium requires analysis in terms of stock equilibrium conditions and stock adjustment processes. It is essential for a balance-of-payments analysis in a fixed exchange rate system to recognize that money can be obtained from two sources--expansion of domestic credit and exchange of goods or assets for international money and conversion of international into domestic money via the monetary authority. In an open economy with given world prices and interest rates, excess demands and supplies reveal themselves entirely in net international flows--balances in the different balance-of-payments accounts--constrained by the identity

$$(X_G - M_G) + (X_B - M_B) + (X_M - M_M) \equiv 0 \ .$$

This basic identity must be supplemented by the economic knowledge that money flows represent a transient process of adjustment to stock disequilibrium with respect to money.

$$X_{M,t} - M_{M,t} = f(D_{M,t} - S_{M,t}) \ ,$$

where D_M and S_M represent, respectively, stock demand for and stock supply of international money (which in turn can be expressed as differences between total demands for and supplies of domestic money and domestic credit money supplied. Since the difference between desired and actual money stocks enter as determinant of the international flow of money along with the specified of the stock adjustment process, the same complex variable must enter as a determinant of net international

flows on at least one of the goods and bonds markets. So these net flows cannot be assumed to have only a flow relationship with a relative price or income flow magnitude (Johnson, 1976b).

Policy implication. According to monetary approach: (a) All balance-of-payments disequilibrium--deficits and surpluses--are monetary in essence. The so-called structural deficits described as inevitable concomitants of underdevelopment simply cannot exist. It is the result of the government relying on inflationary financing of development programs that are paid for by contributions of aid from developed countries. (b) The balance-of-payments disequilibria must inevitably be transitory. (c) All balance-of-payments disequilibria can be handled by the use of domestic monetary policy, without the need for exchange rate changes. (d) Devaluation is only a substitute for domestic credit contraction. The policy of exchange rate change will be ineffective if it is counteracted by an opposite change in monetary policy. Devaluation will have to be repeated unless the initial exchange rate change is accompanied by a monetary policy change towards slower rates of domestic credit expansion. (e) Import quotas, tariffs, exchange controls, and other interferences with trade will improve the balance of payments if their effect is to increase the demand for money by raising the domestic price level. (f) Relatively rapid economic growth will tend to improve a country's balance of payments. But the potential improvement will only be realized if accelerated growth is not accompanied by accelerated domestic credit expansion.

In order to make a comparison between the monetary approach and the nonmonetary approach or the so-called "standard approaches", let's take a look at them briefly.

Elasticity Approach to the Balance of Payments

The new approach to the balance of payments theory that emerged in the 1930s viewed international adjustment not as an automatic process, but as a policy problem for governments. The key problem was the conditions under which a devaluation would improve a country's balance of payments. A devaluation would change the real prices of domestic goods relative to foreign goods in the foreign and domestic markets. If the elasticity condition were satisfied, the impact effect of devaluation would be an improvement in the balance of payments through substitutions in production and consumption. It is clear that three points were ignored in this analysis: (a) the effect of an increase in income on the balance of payments, (b) the connection between the balance of payments and money supply, and (c) the connection between the money supply and aggregate demand. In the immediate postwar period, devaluation proved unsatisfactory and then exchange controls and quantities restrictions were tied as alternatives to devaluation (Johnson, 1958, pp. 153-68).

Absorption Approach to the Balance of Payments

The absorption approach to devaluation argues that a favorable effect from devaluation alone in a fully employed economy depends not on the elasticities, but on the inflation resulting from the devaluation in these conditions producing a reduction in aggregate absorption relative to aggregate production capacity. One part of the mechanism is the real balance effect. The price rise leads to a fall in real balance, which induces a reduction in expenditures.

External and Internal Balance

A country has to have two policy instruments if it is simultaneously to achieve internal and external balance--full employment and balance of payments equilibrium. The instruments could be demand management by fiscal and/or monetary policy and the exchange rate (Mead, 1951). When exchange rate changes are ruled out, a solution can still be found if capital is internationally mobile in response to interest rate differentials. Fiscal expansion and monetary expansion then have the same effects on the current account but opposite effects on capital account. Fiscal expansion increases domestic interest rates and attracts a capital flow while monetary expansion has the opposite effect, so that the two policies can be mixed to achieve a capital account surplus or deficit equal to the current account deficit or surplus (Johnson, 1976a).

Differences between monetary and standard approaches. (a) The standard approaches assume that the monetary consequences of the balance-of-payments surpluses or deficit can be and are absorbed by the monetary authorities, so that a surplus or deficit can be treated as a flow equilibrium. The monetary approach assumes that these monetary inflows and outflows influence the domestic money supply. So the deficits or surpluses are phases of stock adjustment in the money market. (b) The standard models dealing with fiscal-monetary policy mix for balance of payment equilibrium confuses the stock adjustment in the capital account with a flow equilibrium. A model with the need for stock adjustment being continuously recreated is needed. The new monetary models deal with growing economies. (c) The monetary models assume that a country's price level is pegged to the world price level

and must move rigidly in line with it. The standard models emphasize the impact of relative prices on trade flows. (d) The standard models are built on the assumption of mass unemployment, while the monetary approach assumes full employment.

Sterilization of Payment Imbalance

In standard theory, there is a tendency for balance of payment deficits to bring about contractions in the domestic money stock, and for surplus to bring about an expansion. Monetary contraction and expansion, in turn, affects employment, inflation, and credit conditions. The attempt by central banks to override these consequences is called sterilization or neutralization of the money stock. This affects the balance of payments, and can be carried out by any of the familiar tools of monetary policy.

1) Sterilization by open-market operation: This is where a central bank that is financing a balance-of-payments surplus will simultaneously sell government bonds to the public. It thereby withdraws the money added to circulation when it buys official reserves on the foreign exchange market. A central bank that is financing a balance-of-payments deficit by contrast, will simultaneously purchase bonds from the public. It thereby places new money into circulation to replace what the deficit withdrew. In fact, the central bank will plan to purchase government bonds worth exactly the same value as the official reserves that it had to sell to support the exchange rate.

2) Sterilization by changes in commercial bank reserve requirements: It is required by law that commercial banks hold reserves of currency and deposits at the central bank. These enable it to meet

all withdrawal requests from depositors. By reducing reserve requirements, central banks free up reserves, which commercial banks can then loan out to private borrowers, expanding the amount of money in private circulation. In fact, such reduction could compensate for the tendency of a balance-of-payments deficit to reduce the money stock. Increasing reserve requirements, by contrast, would contract the money stock and could be used to absorb extra money created by balance of payment surpluses.

3) Sterilization by discount rate operations: This is where a central bank can influence the money stock by raising and lowering the discount rate--the interest paid by commercial banks that borrow from the central bank to meet reserve requirements.

Sterilization can also be done in other ways, including banking regulations and selling official reserves temporarily by central banks to their own commercial banks in order to sterilize the balance of payments surplus (European central banks are a case in point, where they have simultaneous arrangements to buy the official reserve in the future at a rate attractive enough to make the commercial banks willing to buy and sell) (Richardson, 1980, p. 162).

The most familiar tool used in the Saudi Arabian economy is sterilization by changes in commercial bank reserve requirements. That is, the government controls the quantity of the money supply through the changes in commercial bank reserve requirements. This is because of the unique nature of the Saudi economy, where the government has control over its spending, which affects the gross domestic products and the stock of money.

Foreign Reserve and Inflation

In the past, inflation was thought of mainly as a national phenomenon and was analyzed as such. However, in recent years economists and policymakers alike have become more concerned with the international aspects of inflation. This increasing concern is rather surprising given that the international monetary system underwent at the same time a transition from a predominantly fixed to a floating exchange rate. A large number of economists would have argued that fixed exchange rates facilitate the international transmission of inflation and that flexible exchange rates serve to insulate the national economies from external inflationary developments. For this reason, one might have expected inflation to be an international phenomenon under fixed exchange rates but not under the floating exchange rates that have become common in recent years. Many writers attribute this to the time lag involved since our experience with floating exchange rates is probably too limited to permit a conclusive assessment of the floating exchange rate period.

H. Robert Heller in his article "International Reserves and World-Wide Inflation" (1976) found that there is a systematic relationship between changes in the worldwide aggregate of international reserves and the rate of worldwide inflation with changes in the world money supply serving as the crucial link. Friedman (1970) made a well-known proposition that changes in the national money supply play a role in determining the rate of national inflation. Heller (1976) in his study claimed that there exists a similar relationship between changes in the world money stock and changes in world prices with a lag of

approximately one and a half years in this relationship. He also found that estimates relating changes in global international reserves directly to changes in world consumer prices has a significant lagged relationship. The mean length of the lag was determined to be two and a half to four and a half years. Heller's conclusion was that the sharp increase in international reserves that helped to trigger the worldwide inflation of the early 1970s had an effect on the structure of the recent inflation. The increase in international means of payments in the hands of individual countries led to a world trade boom that resulted in a sharp increase in the prices of internationally traded commodities. Later in 1979, Heller found empirical evidence supporting the existence of a significant lagged relationship between changes in global international reserves and changes in world prices.[1] A 1% increase in reserves is estimated to result in a cumulative price increase of approximately 1/2% within four years. The relationship holds on a worldwide level as well as for the industrial countries and developing countries separately. However, the lag in the relationship appears to be shorter for the developing countries than for the developed countries.

Inflation Caused by Excess Foreign Reserves (BOP's Surplus)

At the beginning, we should make some assumptions that simplify the model and make it practical: (a) Money and goods are the two forms of wealth; (b) import prices are given; (c) there is a full employment;

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[1]For further evidence on the relationship between international reserve and world inflation, see Heller (1979).

(d) the demand for money depends on money income; and (e) the supply of money is determined by the balance of payments, either because international reserves and domestic money are the same, as under a gold specie standard, or because domestic money is rigidly linked to the stock of international reserves through the banking system. Three conditions must be met for equilibrium (Mundell, 1976).

1) The supply of money must be equal to the demand for money.
2) The balance of payments must be in equilibrium; and
3) The demand for domestic output must equal the supply of domestic output. If the first condition is not met, there will be tendency for spending to exceed money. If the second condition is not met, the money supply will be increasing or decreasing. If the third condition is not met, the domestic price level will rise or fall.

Since the community holds money and goods, an excess demand for money means an excess supply of goods, and vice versa. This follows from Walras' law that the sum of the values of excess demands for every economic object (including money) is zero for any individual economic agent. In a closed economy, the excess supply of money employing an excess demand for goods, leads to an increase in the price level, and an excess demand for money implying an excess supply of goods leads to a fall in the price level.

In an open economy, an excess supply of money implies an excess demand for goods in general and an excess of expenditures over income, but the domestic price level would only be pushed up in so far as the excess of expenditures reflected an excess demand for domestic goods.

In so far as an excess demand for goods can be expanded on imports, the price level will have no tendency to rise. Expenditures equal income if the community is satisfied to hold the existing stock of money. An excess of planned expenditures over expected income is proportionate to the excess supply of money. So on the LL line (Figure 1.a, Appendix C) by placing on one axis the quantity of money, M, and on the other axis the domestic price of home produced goods, P expenditure equals income.

Now we assume no capital market. The trade balance is zero when exports equal imports. On BB line (Figure 1.b, Appendix C) the balance of trade is in equilibrium. For a given P, if M rises, there will be excess demand for goods and so import rises leading to a deficit in the balance of trade which needs a fall in the price level for its correction.

It is well known that the money supply will increase or decrease according to whether the balance of payments is positive or negative. We need to find the locus of combinations of money and prices at which there is no excess demand for domestic goods. The excess demand for domestic goods is the difference between the sum of foreign and domestic demands for domestic goods and the level of domestic output. This is equivalent to domestic expenditure plus exports minus imports less the domestic output. On LL, $Y = E$ and on XX, $X = E + B - Y$ (Figure 2a and b, Appendix C). To the right of BB on LL, B is negative and so we have excess supply of domestic goods, which can be corrected by a fall in prices or fall short of income. If the second condition were not met, the money supply would increase or decrease. If the third condition were not met, the domestic price level would rise or fall.

To the right of BB line an increase in M must be associated with an increase in P for X = 0. XX line is positively sloped; an increase in M leads to an increase in expenditure (E) producing an excess demand for domestic goods, which can be corrected by a rise in the price level (P), which reduces foreign demand. Money supply increases or decreases according to whether the balance of payments is in surplus or deficit, and the price level rises or falls according to whether there is inflationary or deflationary pressures.

In summary, the concern here is to show how inflation is generated by a balance-of-payments surplus. A country has a surplus balance of payments when that country is a net exporter. According to the Mundell's theory, this surplus leads to an increase in the money supply (exogneous increase in money supply). When such an increase in money supply is in excess of the demand for money in the economy--assuming that the economy is operating at a full employment level of income and stable demand function for money--excess demand for goods and services will be created. A higher bite in the market for goods and service, or demand-pull, leads to inflation. It is to be noticed here that the foreign reserve flow mechanism of the quantity theory of money to the balance of payments theory owes its origin to specie flow mechanism of David Hume (Rima, 1978). Both of the two theories assert that such external and internal mechanism takes place in the short run, but in the long run--given the assumption of following the fixed exchange system--it is assumed that there is only one rate of inflation that prevails in the world market giving an overall common international rate of inflation.

Exchange Rate System and Inflation

Under the free-floating exchange rate system, the exchange rate is nothing but a price, and prices determined in free markets lead to the efficient allocation of resources. Moreover, there are benefits from the savings of resources used up in managing exchange rates. Besides that, free-floating exchange rates permit the optimal pursuit of a stabilization policy free from all balance-of-payments constraints. This system protects the domestic economy to a great extent from world inflationary pressures. The rate of exchange is determined by the market forces--demand for and supply of an individual country's currency. A currency's value depreciates or appreciates so as to maintain equilibrium between the demand and the supply, thus leaving the balance of payments always in equilibrium. Money does not flow through exchanges, so international payment deficits would never occur, and monetary authorities would be restricted, but the argument here assumes that the central bank knows better than the people what the rate of inflation is in the interest of the nation. They should not be encumbered with the balance of payments difficulties. When a country creates more domestic money that exceeds the money demanded, the consequences of inflation will be reflected on its economy and its own rate of inflation, without altering the inflation rate of its trading partners or the inflation rates of the rest of the world. In contrast, the fixed exchange rate system has traditionally helped national monetary authorities in their fight for price stability, because inflation tends to cause payment deficits and reserve losses, which the guardians of price stability then have used as a justification for the

imposition of monetary and fiscal stringency and a slowdown in the rate of inflation. Under the fixed exchange system, the money supply is the sum of the individual country's money supplies. Any action by any country to increase its money supply will lead to an increase of the world money supply, and hence, a short-run inflation rate in the individual country; and also a long-run inflation rate in the international economies (Heller, 1979).

Costs of Inflation

In summary, there are three sources of inflationary costs in the economy. First, inflation makes it costly to hold money because of its regarding the continuous declining purchasing power. Second, costs arise from the failure of institutions to adapt to inflation. Third, there are a variety of costs arising from the empirical links among the rates of inflation, uncertainity about inflation, and the variability of relative prices.

Inflation can be viewed as a tax on the holdings of currency. The relevant question is whether the costs imposed by the inflation tax are smaller or larger than those of alternative taxes. The evidence is that the inflation tax on currency holdings is a relatively expensive way of raising revenue. Inflation redistributes income in an arbitrary way that distorts society's distribution of income. The actual income distribution should reflect the interplay of the operation of free markets and the deliberate effects of government to alter the distribution. Inflation interferes with and distorts this process. But, inflation that is accurately predicted need not redistribute income between borrowers and lenders. The expected rate of inflation will be

added to the real interest rate. If expectations prove correct, no one gains and no one loses. However, to the extent that expectations prove incorrect, inflation will still redistribute income.

A usury law sets down a maximum permissible interest rate for loan participation. Loans at rates above the usury ceiling are illegal. The problem is that the law places limits on nominal interest rates, rather than on real interest rates, and thus can have rather pervese effects in an inflationary environment. Another cost of inflation is that rapidly changing prices make it difficult to enter into long-term contracts. Neither lenders nor borrowers want to get involved in long-term contracts. But, without long-term loans, business investments become impossible. The economy stagnates. Redistribution of income from wage earnings to residual or profit earnings is another cost of inflation. Again, rising prices increase the cost of price search.

High-average rates of inflation tend to be variable rates. Variable rates of inflation in the long term appear to be more uncertain rates of inflation in two senses. First, individuals disagree more about what the inflation rates would be. Second, each individual is less confident about his own prediction about inflation. Uncertainity about inflation imposes costs on individuals in the absence of a free and perfect mean of protecting their income against inflation. Steady inflation is much more predictable than variable inflation and, therefore, has much smaller social and economic costs.

CHAPTER IV

THEORETICAL MODEL AND DATA SOURCES

Introduction

Some economists believe that the difference in the rate of inflation between countries is attributed to the existence of two sectors within one economy, the tradable and nontradable sectors. It is assumed that price increase in the tradable goods sector are translated to the whole economy through the wage mechanism. That is, an increase in the prices of the imported goods is followed by a wage increase in that sector. The freedom of labor mobility within each country will lead to a transfer of such an increase to the rest of the economy. It is possible to argue that inflation is translated to the whole economy through a wage/price spiral.

Our model estimates inflation rates for both tradable goods and services and nontradable goods and services (construction, communications, transportation, etc.) in the Saudi Arabian economy and examines the interrelationship among inflation, money supply, and foreign assets.

The Model[1]

One of the objectives of this study is to build a theoretical framework for analyzing the relationship between foreign assets, money supply, and domestic inflation. Let

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[1]This model is partially based on a study by Mario Israel Blejer, "Money, Prices, and the Balance of Payments: The Case of Mexico (1950-1973), and one by Michael W. Keran and Ahmed A. AlMalik, "Monetary Sources of Inflation in Saudi Arabia."

$G = g \cdot P$ = nominal government expenditures

$M^d = m^d \cdot P$ = nominal money demand

M^S = nominal money supply

P^* = the rate of inflation

$Y = y \cdot P$ = nominal income (GDP) originating from non-oil sectors

FA = foreign assets .

The lower case letters stand for real variables.

According to conventional theory, the real demand for money is explained in terms of the desire of people to hold real cash balances and is given by

$$m^d = f(y,r) ,$$

where r, the real rate of interest, is nonexistent in the Saudi economy due to the Islamic prohibition on paying or receiving interest. Another variable important in determining the demand for money in the Saudi Arabian economy is the speculative motive in the real estate business during the period of the study. However, since there is no information or available data to capture this variable, we postulate a simple transaction demand for money function:

$$m^d = f(y) .$$

In the Saudi economy, the real nonoil income that influences the real transaction demand for money is predominantly determined by real government expenditures. This is because of the pre-eminent position of the government sector in the Saudi economy. Thus,

$$y = \phi(g)$$

where g is the real government expenditure. Thus, we postulate that

$$m^d = \gamma y \qquad (4.1)$$

and

$$y = \beta g \ .$$

Then,

$$m^d = \gamma y = \beta\gamma g = \theta g \ .$$

This implies that

$$\frac{d\ln m^d}{dt} = \frac{d\ln g}{dt} \quad \text{or} \quad m^{*d} = g^* \ .$$

Now since $M^d = P \cdot m^d$, then

$$M^{*d} = P^* + m^{*d} = P^* + g^* \quad \text{(see Appendix A for details)} \ . \qquad (4.1a)$$

M^d represents nominal money balances demanded, and the rate of change in cash balances is

$$M^{*d} = \frac{d\ln M^d}{dt} \ .$$

P^* in equation (4.1) is the domestic rate of inflation, and m^{*d} is the time rate of change of real demand for cash balance.

Now,

$$M^S = a \cdot B \ ,$$

where

$$a = \text{the money multiplier} = \frac{1 + k}{k + r(1 + t)}$$

and

$$k = \frac{\text{currency outside banks}}{\text{demand deposits}} = \frac{C}{D}$$

$$r = \frac{\text{reserves of banks}}{\text{demand deposits + time deposits}} = \frac{R}{D + t \cdot D} = \frac{R}{D + T}$$

where

$$T = t \cdot D$$

B = Base money

= (C + R) (4.2)

In the specific context of the Saudi economy, since our interest is to examine the external and internal sources of inflation, we utilize the definition of base money from its sources side.

B = (FA - GD) (Burger, 1971, p. 29) , (4.2a)

where

FA = Foreign assets

GD = Government deposits at SAMA .

These two elements are dominant in SAMA's balance sheet. Foreign assets add to base money while government deposits reduce base money. When both increase together, as they typically do in the first instance, there will be no change in base money. Given that foreign assets are determined exogenously, and that government deposits are determined exogenously, also, by the budgetary actions of the fiscal authorities, there may be little room for discretionary monetary policies. The Saudi Arabian economy is a clear case where fiscal policy and monetary policy are not separate tools, but rather, a single tool. Fiscal decisions determine the rate of growth of money. This does not mean that there are no controls on base money. In fact, one automatic mechanism, the link between foreign assets and government deposits, provide a substantial amount of control over the growth of base money. In addition, SAMA makes effective use of one major policy tool, reserve requirements.

In the standard theory, B = DC + FA - GD when considered from sources side. Here DC = the domestic credit components of central bank

assets and is proportional to the budget deficit. This component of reserve can be ignored in the case of Saudi Arabia due to the nature of the Saudi budget, where the country accumulates a huge foreign reserve surplus over many years. This is coupled with an underdeveloped financial market and budgetary surpluses. Thus, for the Saudi economy,

$$M^S = a \cdot B \ .$$

Substituting for B from equation 2 gives us

$$M^S = a(FA - GD) \ .$$

Thus,

$$M^{*S} = a^* + B^* = a^* + (FA - GD)^* \qquad (4.3)$$

(see Apendix for details).

By subtracting the flow demand for nominal balances from the supply variables, using equations 4.1 and 3.4, we obtain E, the gap in percentage terms between the changes in the money supply and the demand.

$$E = M^{*S} - M^{*d} = a^* + (FA - GD)^* - P^* - m^{*d} \ .$$

Since (FA - GD) = B, so that

$$E = M^{*S} - M^{*d} = (a^* + B^* - P^* - m^{*d}) = (a^* + B^* - P^* - g^*) \ . \qquad (4.4)$$

When there is excess money supply, people buy more foreign goods. This, in turn, reduces foreign assets, and, at the same time, affects domestic inflation through imported inflation, and through the inadequacies of domestic infrastructural facilities (ports, roads, etc.). We assume that there are two kinds of goods, tradeables and non-tradeables, which are produced and consumed in the country. Tradeable goods include exportables and importables, whose prices are determined

exogenously in world markets. Thus, in Saudi Arabia, we have the terms of trade as fixed. The price determination of the nontradeable goods can be explained as follows:

The overall price level in the economy will be a geometrically weighted average of the two kinds of goods, and its rate of change can be written as

$$P^* = ZP_T^* + (1-Z)P_{NT}^* , \qquad (4.5)$$

where P_T is the price of tradeable goods, P_{NT} is the price of nontradeable goods, and (Z) is the expenditure share of the tradeable goods.

In an open economy, only the rate of domestic inflation relative to world inflation is determined by the domestic flow excess supply of money. If we assume that excess demand for nontradeable goods varies monotonically with the excess demand in the economy, we can write the following equation for the relative prices:

$$\frac{P_{NT}}{P_T} = ne^{\delta E} . \qquad (4.6)$$

This means that for each level of the gap between the percentage change in money creation, and the changes in its demand, there will exist a unique relative price of nontradeables in terms of tradeable goods.

is the elasticity of the relative prices with respect to the monetary imbalances. It takes a value between zero and , and for the specific context of Saudi economy, is a function of income elasticity and elasticity of substitution in consumption. From equation (4.6), we obtain the difference between the rate of change of the relative prices,

$$P^*_{NT} - P^*_T = \delta \frac{dE}{dt} . \tag{4.7}$$

For convenience, the analysis is presented henceforth in terms of discrete percentage changes of the variables over time, using the difference operator (D), and the technique of proportional differentiation as follows. For any variable, x:

$$DX = (X_t - X_{t-1})$$

$$X^* = \frac{DX}{X_{t-1}}$$

$$DX^* = X^*_t - X^*_{t-1} = \frac{DX}{X_{t-1}} - \frac{DX_{t-1}}{X_{t-2}} .$$

By applying the D operator, we can then rewrite (4.7)

$$P^*_{NT} - P^*_T = \delta(DE) . \tag{4.8}$$

And, by using equation (4.4), we can write

$$(P^*_{NT} - P^*_T) = \delta[D(a^* + B^* - P^* - m^{*d})] .$$

By applying the D (operator) to P*, we obtain

$$DP^* = P^*_t - P^*_{t-1}, \text{ so that}$$

$$(P^*_{NT} - P^*_T) = \delta[D(a^* + B^* - m^{*d})] - P^*_t + P^*_{t-1} , \tag{4.9}$$

and by substituting equation (4.5) into equation (4.9), we obtain, after some manipulation, equation (4.10). First, let

$$(a^* + B^* - m^{*d}) = W^*$$

$$(P^*_{NT})_t = \frac{\delta}{1 + (1-Z)\delta} \cdot (DW^*)_t + \frac{1 - \delta Z}{1 + (1-Z)\delta} \cdot (P^*_T)_t +$$

$$\frac{\delta}{1 + (1-Z)\delta} (P^*_{t-1}) . \tag{4.10}$$

Combining equation (4.5) and equation (4.10), we have the domestic rate of inflation in Saudi Arabia as a function of the world rate of inflation (assumed here to be equivalent to P^*_T, the rate of change of average world prices in the tradeables), the rate of change of the excess supply of money, and the past year's rate of inflation.

$$= P^*_t = \frac{1}{1 + (1-Z)\,\delta} \cdot (P^*_T)_t + \frac{(1-Z)\,\delta}{1 + (1-Z)\,\delta} \cdot (DW^*)_t +$$

$$\frac{(1-Z)\,\delta}{1 + (1-Z)\,\delta} \cdot P^*_{t-1} \qquad (4.11)$$

Source of Data

Basically all the data series is available on an annual basis. It should be pointed out, furthermore, that limited data availability resulted in the size of the present sample (twenty-one observations) being a small sample according to most statistical standards.

The main sources for the data are International Financial Statistic (IFS), 1982-84; SAMA's Annual Reports 1971-84, and Direction of Trade Annual, and Yearbook, 1963-83.

CHAPTER V

EMPIRICAL RESULTS OF THE STUDY

Introduction

This chapter concerns the empirical results derived from the model presented in the previous chapter. These results will be discussed and analyzed. The first section discusses the statistical procedures used. The second section presents the ordinary least-square estimation technique to explain inflation in Saudi Arabia from 1963 to 1983. An attempt is also made to identify whether any structural shift occurred in the Saudi economy impacting inflation during this period.

Statistical Procedure

The major concern of this part of the present study is to test empirically the model developed and to analyze the factors explaining inflation in the Saudi Arabian economy from 1963 to 1983. One of the most important decisions that should be made in any econometric model is the selection of the appropriate statistical procedure for the estimation of the structural coefficients. But before the appropriate estimating method is chosen, the model specified in the previous chapter has to be set in an estimatable form. For this purpose, it is assumed that a linear relationship exists between the dependent variables (overall inflation (P^*_t), the inflation rate generated from nontraded goods sector $(P^*_{NT})_t$, and the real demand for money (m^d)), and the explanatory variables, such as real nonoil income $(y)_t$, the rate of

change in excess supply of money $(DW^*)_t$, and the world inflation rate $(P_T^*)_t$. It is assumed further that the dependent variable is linearly related to a stochastic disturbance term (U_t). In matrix notation, this relationship can be expressed as

$$Y = X\beta + u \,, \tag{5.1}$$

where

Y = n x 1 - vector of dependent variables

X = n x k - vector of independent variables

β = k x 1 - vector of unknown coefficients

u = n x 1 - vector of disturbance term.

For the estimation of the unknown coeffients, the assumption of the linear model are maintained by having the following properties:

1) Normality and zero mean, where the disturbance terms are normally distributed with zero expectation

$$E(u_i) = 0 \,.$$

2) Nonautoregression, where the disturbances are uncorrelated

$$E(u_i u_j) = 0 \text{ for } (i \neq j) \,.$$

3) The covariance matrix of the disturbance in a behavioral equation is the same for all i,

$$E(u_i u_i') = \quad ; \text{ for } i = 1, 2, \ldots, i \,.$$

4) The explanatory variables are uncorrelated with disturbances

$$E(X'u) = 0$$

Estimable Form of the Model

The estimable model of inflation in Saudi Arabia is specified as follows:

The Money Demand equation (4.1) can be expressed as

$$M_o/CPI = \gamma_o + \gamma_1 y_t + u \ , \qquad (5.2)$$

where y = real nonoil gross domestic product and M_o/CPI = real currency outside banks.

The inflation in the nontraded goods sector as represented by equation (4.10) can be stated as

$$(P^*_{NT})_t = \beta_o + \beta_1 (DW^*)_t + \beta_2 (P^*_T)_t + \beta_3 P^*_{t-1} + u \ . \qquad (5.3)$$

The overall inflation equation (4.11) can be expressed also as

$$P^*_t = \alpha_o + \alpha_1 (P^*_T) + \alpha_2 (DW^*)_t + \alpha_3 P^*_{t-1} + u \ . \qquad (5.4)$$

In these equations γ_o, β_o and α_o represent the constant terms in each equation. The other coefficients γ_1, β_1, ... β_3, α_1, ... α_3 represent the rate of change of the dependent variable with respect to the respective explanatory variables. The subscript t refers to time period.

Method of Estimation

The most common method for estimating the values of unknown coefficients in a model like the present one is the ordinary least-squares method (OLS). It is the most widely used technique of estimation. It has some basic assumptions to be maintained, which are stated as

$$E(u_i) = 0 \quad \text{all } i$$

$$\text{Var}(u_i) = \alpha^2 < \infty \quad \text{all } i \tag{5.5}$$

$$\text{Cov}(u_i, u_j) = 0 \quad \text{all } i,j,\ i \neq j$$

$$X_{ij} \text{ is fixed} \quad \text{all } i,j\ ,$$

where X_{ij} stands for the explanatory variables in equations (5.2), (5.3), (5.4), and represent value taken by the j^{th} explanatory variable at the i^{th} observation, and the stochastic assumptions in equation (5.5) concern the stochastic disturbance terms u_i, which are unobservable random variables. They state that each of the stochastic disturbance terms has a zero mean, that all stochastic disturbances have the same (finite) variance, and that each pair of stochastic disturbance terms has a zero covariance (Intriligator, 1978, p. 84, 599-617).

The majority of researchers agree that the OLS method of estimation is the best, linear, unbiased estimator (BLUE) and it gives consistent and efficient estimators, especially in large samples.

The Procedures of Evaluation an Emperical Result

To evaluate empirical results, the researcher usually takes two kinds of evaluation in account throughout the analysis. First, the statistical evaluation, where following measures are checked.

1) The measure of the "goodness of fit," which is known as the coefficient of determination and denoted by R^2. This is simply the proportion of the variation of the dependent variable that can be attributed to the variation of the explantory variables, and it is a measure commonly used to describe how well the sample regression line

fits the observed data. Note that R^2 cannot be negative or greater than one, i.e.,

$$0 \leq R^2 \leq 1 .$$

A zero value of R^2 indicates the poorest fit, while a unit value indicates the best fit that can be attained (Kmenta, 1971, pp. 232-34).

2) The measure of the t-test, where the t-ratio is the ratio of the estimated regression coefficient to its standard error, which determines the significance of the coefficient. It is the test of the hypothesis that the coefficient of one of the explanatory variables is zero. Accordingly, researchers test the hypothesis that the corresponding independent variable has no significant effect on the dependent variable. If the absolute value of t estimated is greater than the theoretical value of the t-table, at a specific level of significance, then the hypothesis that the specitic coefficient is zero is rejected, and vice versa. A high t-ratio implies that the coefficient is significantly different from zero, and the dependent variable is linearly dependent on the relevant independent variable.

3) The measure of testing for serial correlation. The existence of serial correlation is a common problem in economics. The most frequent cause of this problem is the trend in economic time series, where they all increase over time. The time trend also shows in the residuals, i.e., $y = \alpha + \beta X + u$, where u is the difference between the actual value of y and the value of y found by using the estimated coefficients β and α. In general, the actual and calculated (estimated) values are not the same. There is always some part of the dependent variable (y) that cannot be explained by the model. The Durbin-Watson d-statistic (D-W-d)

is the most widely used statistical method for checking the independence of error terms. It is the ratio of the sum of squares of successive differences of residuals to the sum of the squared residuals, and it measures how closely the residuals are related to each other.

There is disagreement about the acceptable range for the D-W-d, but if D-W-d $\simeq$ 2, there is no first-order serial correlation, and some suggest that a range between 1.6 and 2.4 will be acceptable (Moliver, 1980, p. 140). For dealing with the problem of serial correlation in this study, the plan is to use the Cochrane-Orcutt technique, which usually gives a new β's and α's and usually results in a better D-W-d stastic, and also an improved F-ratio and R^2.

4) The measure of the F-test. The F-statistic is similar to a t-statistic, but applied to the R^2. It tests the significance of the regression as a whole in testing for the existence of a linear relationship between the dependent variable and all of the independent variables specified by the model. If the estimated F exceeds the F-table value at a particular level of significance, then the null hypothesis of no dependence on the independent variables is rejected, which implies that the model therefore has some explanatory power and vice versa.

The second type of evaluation tool is economic interpretation. This is the economic interpretation of empirical results. Based on the economic model, economic interpretation tries to explain whether the empirical results conform to the qualitative results suggested by economic theories. If not, then why?

The Estimation of Money Demand Equation

In the Saudi Arabian economy, the distinction between currency and

demand deposits is significant relative to the case of the United States or any other Western country. Wages, salaries, and household spending are paid in currency. Interest payments on all types of deposits are legally prohibited. The majority of people hold demand deposits and most of the other types of deposits for their convenience and for security purposes. As has been mentioned before (Chapter IV), that transaction demand is assumed to be directly proportional to the volume of private transactions as measured by real nonoil gross domestic product (nonoil GDP). For purposes of comparison, an estimation of the real demand for money based on alternative definitions of money is presented here.

The estimation of the real demand for money is a matter of considerable importance for the construction of the excess supply of money series which is one component of the explanatory variables of equation (5.4), indicating the inflation rate generated from the nontraded goods sector, and also of equation (5.5), indicating overall domestic inflation.

The Cochrane-Orcutt estimated coefficients of the nonoil real GDP are presented in Table 5.1. Moreover, all the statistical tests are presented in the table. The coefficient of determination R^2 is highly significant for all the three definitions of money used. This indicates a good fit. The F-ratio also is statisticallly different from zero for all the equations. The t-values are very high in all the three explanatory coefficients and are significantly different from zero. However, the D-W-d statistic has a different picture. Where the first equation indicates an absence of first-order serial correlation, the other two equations indicates an existence of first-order serial

Table 5.1 Cochrane-Orcutt estimated coefficients of real demand for money in Saudi Arabian economy, 1963-83.

Dependent variable	Constant	Coefficient	
M_o/CPI	-2.1528 (-7.78)	0.7466 (46.06)	R^2 = .9979 D-W-d = 1.74 SE = 0.218 F = 4605.5
M_1/CPI	-8.2087 (-6.99)	1.9066 (28.84)	R^2 = 0.9969 D-W-d = 1.56 SE = 0.218 F = 3021.04
M_2/CPI	-15.1268 (-4.727)	2.9375 (19.19)	R^2 = 0.9972 D-W-d = 1.51 SE = 0.218 F = 3372.11

Note: All the coefficients are the Cochrane-Orcutt estimation. The t-values are given in parentheses below the coefficients.

correlation. For all the explanatory variables the coefficients have the theoretically desired sign. In particular, the nonoil GDP coefficient associated with M_o/CPI (in real currency) has the largest multiple coefficient of determination R^2, and the highest F-statistic value. This finding supports the theory with respect to the relation between real money demand and currency mentioned in Chapter III.

An increase (decrease) of 1% in real nonoil gross domestic product will cause an increase (decrease) in real demand for money by 0.7466%. The real demand for money will be calculated according to the following empirically estimated coefficients.

$$(M_o/CPI)_t = \underset{-(10.28)}{-2.15} + \underset{(58.23)}{0.7466}\, y_t \qquad (5.2a)$$

R^2 = .9979 SE = .218 D-W-d = 1.74 F-ratio = 4605.5 .

The calculation of real demand for money, excess money supply and all other data required for further empirical estimation are included in Appendix (A).

Empirical Estimation of Inflation

The main objective of this chapter is to estimate and present the empirical results of inflation in Saudi Arabian economy in terms of the theoretical model developed earlier in Chapter IV.

Separate regression estimates are derived to see which explanatory variables significantly affect inflation generated through changes in the price level of the nontraded goods sector, and to see which explanatory variables affect overall domestic inflation. Furthermore, a test is performed to identify any shift in the economic structure of Saudi Arabian economy during the period of study, 1963-83. This period, as has been mentioned earlier, is divided into two subperiods, 1963-72 and 1973-83. The first period was a period of low income, with a small private sector, and a low rate of inflation. The second period was a period of high income, with a growing private sector, and a high inflation rate, nationally as well as internationally.

Empirical Results of Inflation Associated with Nontraded Goods Sector

Equation (5.4) presents the rate of inflation in the nontradable sector as a function of the flow of excess supply of money, and the rate of change of the price level of tradable goods, as well as of the past rate of inflation.

The rate of change of the excess money supply is calculated by adding the rate of change of supply of real money (currency) and

subtracting the estimated rate of change on the real demand for money using the coefficient estimated earlier.[1] The price level of the tradable goods is approximated by the weighted average price level of the top ten trading partners in the Saudi Arabian foreign trade. The share of each of these countries in the total value of export to Saudi Arabia is used as the weight.[2] The last explanatory variable is the past rate of inflation (P^*_{t-1}).

The estimated equation is

$$(P^*_{NT})_t = \underset{(1.21)}{1.65} + \underset{(.084)}{0.0072}\ (DW^*)_t + \underset{(3.48)}{0.54}\ (P^*_T)_t - \underset{(-1.21)}{0.74}\ P^*_{t-1} \qquad (5.3a)$$

$R^2 = 0.8753$ D-W-d = 1.98 SE = 0.33 F-ratio = 8.77 .

The above results for equation (5.3a) hold for the first period of the study 1963-73.[3] By applying all the conventional statistical tests on the model, it is clear that the coefficient of determination R^2 has an acceptable value. The D-W-d statistic indicates the absence of first-order serial correlation. The F-ratio indicates that the coefficients of the explanatory variables as a group are statistically different from zero at a 1% level of significance. All the coefficients of the independent variables excepting that of the past rate of inflation have the expected signs. Theory suggests a positive sign of the past rate of inflation. But this empirical behavior is understandable for an economy like Saudi Arabia's, and especially for that period

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[1] For more details, see Appendix B.

[2] For more details, see Appendix B.

[3] Equations (5.3) and (5.4) were based on data available from 1965-83 since we lose two observations during our calculations, 1963-64 (Appendix A).

of time when the average domestic rate of inflation was approximately 2% per annum compared to the world average of 5% per annum. Besides during that period of time the economy of the country had specific characteristics of being less significant to the outside world, low per capita income, and very small private sector. But the major reason for this empirical result may be related to the unique nature of the Saudi economy and the deflationary policy taken by the government (as mentioned in the previous chapters) to keep inflation under control. At that time, nontraded goods sector (housing, electricity, health services, ports, roads, etc.) was relatively very small. The government followed various policies to motivate and encourage the growth of this sector. These policies included subsidies and the development of all needed infrastructural facilities and were effective in achieving the goals of growth of the nontraded goods sector and reduction of inflation. Of course, the impact on the latter was felt with a time lag, in later years (during the second subperiod 1973-83).

All the coefficients of the independent variables excepting that of the world rate of inflation are not independently statistically different from zero at the 5% level of significance. An increase of the world rate of inflation by 1% would increase the domestic rate of inflation generated through the nontraded goods sector by 0.54% during the same period.

The empirical results of the same equation for the second period 1973-1983 are as follows:

$$(P^*_{NT})_t = \underset{(0.88)}{6.33} - \underset{(-0.55)}{0.03}\,(DW^*)_t + \underset{(0.45)}{0.27}\,(P^*_T)_t + \underset{(2.24)}{0.93}\,P^*_{t-1} \qquad (5.3a')$$

$R^2 = 0.7882$ D-W-d = 2.03 SE = 0.31 F-ratio = 5.58 .

The statistical properties of the fitted regression show that it is a moderately good fit of the model. R^2 is not as high as in the earlier period, but it is within the acceptable range. It implies that not all the variation in the dependent variable can be explained by the variations in the explanatory variables included in the model. The F-ratio indicates that the explanatory variables as a whole are statistically different from zero at the 1% level of significance. The D-W-d statistic indicates an absence of the first-order serial correlation. All the explanatory variables have the expected signs except the rate of change of excess supply of money. This result contradicts the theory that the excess supply of money is inflationary. An increase of excess supply of money by 1% will cause inflation associated with non-traded goods sector to decrease by 0.03%. However, it should be noted that neither the magnitude of the coefficient (0.03) is high nor is it statistically significant. This result may be attributed to one or both of the following reasons. First, the money supply in Saudi Arabia economy does not follow the usual channels known in banking literature and followed by most countries. Accordingly, the usual money-price level interrelation cannot be always expected without exception in such an economy where the public sector plays an overwhelming role in activating and controlling the economic activities. Secondly as Appendix (A) shows, the rates of change in excess supply of money during the second period 1974-83 are mostly negative, indicating clearly that an increase in the rate of real demand for money outstripped the increase in the rate of money supply. This might have occurred because of the high real income and high productivity generated during this period. The inflation rate had been accelerating in the

world market during the 1970s, and that inflationary pressure affected the Saudi economy. This is not unexpected, since the Saudi economy is one of the most open economics in the world. The inflation rate in Saudi Arabia ran relatively high during the second period of this study, especially during 1974-77. This trend may be attributable to economic conditions in the world at that time, and the sudden change in the nation's wealth through the transfer of ownership of oil fields from the operating companies to the government of Saudi Arabia. The government in its turn started massive developmental expenditures. The empirical results show that only the past rate of inflation is statistically different from zero at the 5% level of significance, while the world inflation has no significant effect. This may be due to the inflationary expectations of the people which were high during the early years of the second period and went down in the later years due to effective anti-inflationary policies pursued by the government.

> From a descriptive statistics point of view, it may be stated that whereas in the 1964-72 period annual monetary expansion of 13 percent cushioned an average rate of inflation of 2.4 percent, in the period 1973-78 liquidity expansion of 5.18 percent per annum generated an annual rate of inflation of 18.9 percent. It must be pointed out, however, that the government's deflationary policies have begun to take effect. The rate of inflation actually declined (-1.6 percent) in 1978 (El Mallakh, 1982b, p. 331).

The overall regression results for the entire period 1963-83 are the following:

$$(P^*_{NT})_+ = \underset{(0.72)}{2.41} - \underset{(-0.54)}{0.01}\,(DW^*)_+ + \underset{(0.57)}{0.18}\,(P^*_T)_+ + \underset{(4.57)}{1.10}\,P^*_{+-1} \qquad (5.3a'')$$

$R^2 = 0.76$ D-W-d = 2.03 SE = 0.23 F-ratio = 11.87 .

The fitted regression appears to fit the model moderately well. For the whole regression, the F-ratio is significant at the 1% level.

An almost perfect D-w-d statistic confirms the absence of first-order serial correlation. All independent variables have the expected signs except the rate of change in excess supply of money. However, all the coefficients are not statistically different from zero at the 5% level of significance except the past rate of inflation coefficient, which is statistically different from zero at the 0.5% level of significance. The linear relation between the past rate of inflation and the dependent variable implies that a 1% increase in the past rate of inflation increased the inflation generated from nontraded goods sector by 1.1%. This can be explained by the increase in adaptive type of expectations of inflation during the second period, especially in the 1970s. The rapid growth of the private sector combined with inadequate domestic facilities to meet the high growth in private demand during the period further strengthened inflationary pressure.

Since we have the empirical results of two distinct periods, and another empirical result for the whole period, it is important to check if any structural shift in the Saudi economy occurred between these two distinct periods. The statistical tool that can be used to determine whether any structural shift has taken place in between the two time periods is the Chow-test.[4] The test statistic is

$$\frac{SSE - (SSE_1 + SSE_2)/k}{(SSE_1 + SSE_2)/(N_1 + N_2 - 2k)} \simeq F(k, N_1 + N_2 - 2k)^5 \qquad (5.6)$$

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[4]For more details about the Chow-test, see Appendix (B)

[5]If the computed F exceeds the critical F, reject the hypothesis that the two regressions are the same (Gujarati, 1978, pp. 305-6).

where

SSE = the residual sum of squares of the regression related to the whole period, 1963-83, and

SSE_1 = the residual sum of squares of period 1, 1963-73

SSE_2 = the residual sum of squares of period 2, 1974-83

N_1 = the number of observations in period 1

N_2 = the number of observations in period 2

k = degree of freedom.

For the present model, the Chow-test statistic derived is as follows:

$$F = \frac{1668.9848 - (20.63 + 1446.29)/4}{(20.63 + 1440.29)/11} = 0.4 \ . \qquad (5.6a)$$

This result is not statistically different from zero at the 5% level of significance. This leads to the acceptance of the hypothesis that the two regressions are the same and indicates that no shift related to nontraded goods sector prices has occurred in the economic structure of Saudi Arabia during the period of study.

Emperical Results with Respect to the Overall Domestic Inflation

Equation (4.11) indicates that the overall domestic rate of inflation in the Saudi Arabian economy is a function of the world rate of inflation (assumed to be equivalent to the rate of change of the average world prices of the tradables), the rate of change of excess supply of money, and the past year rate of inflation.

The esimated equation for the first period 1963-73 is

$$P_t^* = \underset{(0.88)}{0.85} + \underset{(10.09)}{0.97}\ (P_T^*)_t + \underset{(0.24)}{0.001}\ (DW^*)_t - \underset{(-3.11)}{0.97}\ P_{t-1}^* \qquad (5.4a)$$

$R^2 = 0.9749$ D-W-d = 1.78 SE = 0.33 F-ratio = 48.49 .

An examination of the statistical properties of the estimated regression show clearly that it is a good fit. The coefficient of determination R^2 is very high. The D-w-d statistic indicates an absence of first-order serial correlation, F-ratio shows that the explanatory variables as a group are significantly different from zero at the 1% level of significance.

All the coefficients of the explanatory variables have the expected signs except for the coefficient of the past year's rate of inflation which, contrary to the theory, has a negative sign. This may be due to the policies followed by the government. The policies include subsidies to the private sector and to the semiprivate sector in order to slow down the pressure of the world inflation and domestic price level and to achieve some economic goals (mentioned before). All the coefficients of the independent variables separately are statistically different from zero at the 1% level of significance excepting the coefficient of the rate of change of excess supply of money. A 1% increase in the world rate of inflation will increased domestic inflation by 0.97% while a 1% increase in the previous year's inflation rate will cause a reduction in the current inflation rate by 0.97%.

The estimated regression of the same equation (4.4) for the second period 1974-83 is the following:

$$P^*_t = \underset{(0.51)}{3.87} - \underset{(-0.114)}{0.04}\,(P^*_T)_t + \underset{(0.166)}{0.004}\,(DW^*)_t + \underset{(1.78)}{0.61}\,P^*_{t-1} \qquad (5.4a')$$

$R^2 = 0.8032$ D-W-d = 1.28 SE = 0.31 F-ratio = 6.12

The Cochrane-Orcutt iterative technique did not improve the D-W-d statistic much, as it still shows the existence of first-order serial correlation, while the other statistical tests show a good fit. The adjusted R^2 indicates that more than 80% of the variation of the dependent variable can be explained by the variation in the explanatory variables. The F-ratio shows the significance of the ratio as a whole at the 5% level. All the signs of the independent variables are as expected excepting the sign of the rate of change in world price. This phenomenon has been explained previously in connection with the inflation trend during the second period.[6] The domestic inflation rate declined, but at a smaller rate than the decline in the world rate. Import prices declined as a result of the substantial deceleration of the rate of inflation in Saudi Arabia's major trading partners. The appreciation of the Saudi Riyal against some major currencies and the SDR also strengthened the process. Only the coefficient of the past rate of inflation is statistically different from zero at the 10% level of significance. This implies a significant linear relation between the expectation of inflation and the overall domestic inflation. A 1% increase in expectation of inflation will increase the domestic inflation rate by 0.61%.

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[6] See Appendix (A).

The estimated regression for the whole period, 1963-83, is

$$P^*_t = \underset{(0.61)}{2.04} + \underset{(0.48)}{0.12}\,(P^*_T)_t - \underset{(-0.16)}{0.002}\,(DW^*)_t + \underset{(3.1)}{0.6}\,P^*_{t-1} \qquad (5.4a'')$$

$R^2 = 0.7792$ D-W-d = 1.74 SE = 0.23 F-ratio = 13.2 .

Applying all the conventional statistical tests on the estimated equation, it is seen that F-ratio is statistically different from zero at a 1% level of significance, indicating the power of the explanatory variables as a group. The coefficient of determination R^2 is moderately high. The D-W-d statistic indicates an absence of first-order serial correlation. A 0.6% will be added to the domestic inflation rate as a result of a 1% increase in the past rate of inflation. All coefficients of the independent variables are not statistically different from zero at the 5% level of significance except the coefficient of the past rate of inflation. All the signs of the coefficients are as expected, excepting the sign of the rate of change in excess supply of money, which has been explained earlier.

The Test for Structural Shift

To see whether a structural shift occurred during these two periods or not, we apply the Chow test as follows:

$$F = \frac{SSE - (SSE_1 + SSE_2)/k}{(SSE_1 + SSE_2)/(N_1 + N_2 - 2k)} \qquad (5.7)$$

$$= \frac{787.541 - (8.913 + 684.6494)/4}{(8.913 + 684.6494)/11} = 0.4 \qquad (5.7a)$$

The critical F is greater than the calculated F, so we accept the hypothesis that no structural shift occurred during these two subperiods.

These results in both F-tests (5.6a) and (5.7a) show that the economy of Saudi Arabia maintained its pattern of performance over many years following a short-term adjustment designed carefully by the authorities to absorb and to adjust to the pressures of world inflation, and domestically created inflation. The government was using various tools in different years. In early years it used different incentives to stimulate the growth of the private sector, providing subsidies, and needed infrastructural facilities. Later on and during the years of high domestic and world inflation rates, the government followed contractionary policies, applying control over its own expenditures in order to slow down the pressure of inflation. These policies seem to have been successful and effective in achieving the goal. It is to be noted that from 1973 to 1977 has been the most critical period regarding the magnitude of prices, inflation, and quantity of money.

The absence of structural changes in the Saudi Arabian economy during the period of study may also be attributed partially to the outflow of much of the accumulated capital outside the country, searching for an investment opportunity abroad. This occurred because the Saudi economy did not have the high-absorption capacity to match and contain the huge amount of oil revenue that the country was earning.

Causal Ordering Across World Inflation, Money Supply, and Domestic Inflation in Saudi Arabia

Introduction

The relationships among inflation, the money supply, and world inflation have been debated in economic literature. It is a well-known proposition that changes in the national money supply play a role in

determining the rate of national inflation. Monetarists tend to agree that the quantity of money is the prime determinant of the level of prices and economic activity, and that excessive or insufficient monetary growth is responsible for economic fluctuations. Friedman has suggested a growth rate for money of 2, 4, or even 5% may be desirable. As he has expressed it,

> By setting itself a steady course and keeping to it, the monetary authority could make a major contribution to promoting economic stability. By making that course one of steady but moderate growth in the quantity of money, it would make a major contribution to avoidance of either inflation or deflation of prices. (Dornbusch and Fisher, 1981 p. 299)

Heller (1979) found empirical evidence supporting the existence of a significant relationship between changes in global international reserves and changes in world prices. As he stated,

> A 1 percent increase in reserves is estimated to result in a cumulative price increase of approximately 1/2 percent within 4 years. The relationship holds on a world-wide level as well as for the industrial countries and developing countries separately. However the lag in the relationship appears to be shorter for the developing countries than for the industrial countries (p. 247).

The foregoing theoretical considerations suggest that it is useful to investigate empirically the pattern of causal ordering across world inflation and/or money supply and domestic inflation for the case of Saudi Arabia in order to judge whether there is a unidirectional causality from money supply and/or world inflation to domestic inflation or vice versa. In the current study, we have the domestic rate of inflation as a function of the world rate of inflation, the rate of change of excess supply of money, and the past year's rate of inflation.

The Bivariate Test Procedure

Various tests can be used to test causal ordering of time series. Many procedures have become available for testing the direction of causation in bivariate contexts since the work by Sims (1972), Sargent (1976), Dent and Meese (1983). However, most of these tests are based on the concept of causality established by Granger (1969), where X_2 "causes" X_1 if and only if $X_1(t)$ is better predicted by using the past history of X_2 than by not doing so with the past of X_1 being used in either case. If X_2 causes X_1 and X_1 does not cause X_2, it is said that unidirectional causality exists from X_2 to X_1. If X_2 does not cause X_1, and X_1 does not cause X_2, then X_1 and X_2 are either statistically independent or related contemporaneously, but in no other way. If X_2 causes X_1 and X_1 causes X_2, it is said that feedback exists between X_1 and X_2 (Granger, 1969; Guikley and Salemi, 1982). This method was also followed by Geweke, Tjostheim and Hsio, and has been shown to be more powerful than the causality tests of Sims or Haugh on the basis of Monte Carlo studies (Guilkey and Salemi, 1982; Geweke et al., 1983; Nelson and Schwert, 1980).

Granger-Causal Ordering

The study by Guilkey and Salemi (1982) and also the study by Geweke et al. (1983) concluded that Granger's method for testing causal ordering is superior to others, especially for small samples. The version of the Granger test as explained by Guilkey and Salemi (1982) is based on ordinary least-squares and performed by examining the significance of the group of parameter estimate of an autoregressive

model as a whole through the use of an F statistic. In our study, this can be done through the estimation of the following equations.

$$P_t^* = a + \sum_{j=1}^{J} a_j P_{t-j}^* + \sum_{j=1}^{J} b_j (DW)_{t-j}^* + U_t \qquad (5.8)$$

$$P_t^* = a + \sum_{j=1}^{J} a_j P_{t-j}^* + \sum_{j=1}^{J} b_j (P_T)_{t-j}^* + U_t \qquad (5.9)$$

$$P_t^* = a + \sum_{j=1}^{J} a_j P_{t-j}^* + \sum_{j=1}^{J} b_j (P_{NT})_{t-j}^* + U_t \qquad (5.10)$$

where

P_t^* = overall domestic inflation

DW^* = excess supply of money

P_T^* = world inflation

P_{NT}^* = inflation generated in non-traded goods sector

U_t = disturbance term

$t-j$ = number of lags.

The test statistic is calculated by estimating the above equations in both constrained and unconstrained forms, and may be written as

$$F = \frac{(SSE_c - SSE_u)}{SSE_u/[T - (2J + 2)]}, \qquad (5.11)$$

where

SSE_c = constrained residual sum of squares.

SSE_u = unconstrained residual sume of squares.

J = lag length.

Since the sample is quite small and the data is yearly, the trend is omitted in the previous equations and can be considered to be stationary.

The test of the hypothesis that the independent variable does not Granger cause the dependent variable is the test that $b_j = 0$ for all j and will be followed.

The Main Bivariate Results

Tables 5.2, 5.3, and 5.4 contain all information needed to calculate the F-statistic for testing the hypothesis of no causality from the independent variable to the dependent variable. Table 5.2 shows that the hypothesis of no causality from excess supply of money to overall domestic inflation, and from overall domestic inflation to excess supply of money have been tested. Evidently, an insignificant F-value implies an acceptance of the hypothesis of "no causality" for both equations in Table 5.2.

Table 5.3 shows testing of the hypothesis of causal relationship between world inflation and overall domestic inflation in Saudi Arabia and from Saudi Arabian overall domestic inflation to world inflation. The F-computed value for the first equation is clearly significant at the 5% level, indicating a rejection of the hypothesis of no causality, and this implies that world inflation causes domestic inflation. Conversely, a small value of the F-statistic for the causality direction from domestic inflation to the world inflation fail to reject the hypothesis that P_t^* does not cause $(P_T^*)_t$).

Table 5.4 contains F-statistic for testing of the hypothesis of no causality from inflation generated in nontraded goods sector $(P_{NT}^*)_t$ to

Table 5.2 Causal relations between overall domestic inflation and excess supply of money in Saudi Arabian economy, 1963-83.

$P^*_t = a + \sum_{j=1}^{J} a_j P^*_{t-j} + \sum_{j=1}^{J} b_j (DW^*)_{t-j} + U_t$		$(DW^*)_t = a + \sum_{j=1}^{J} a_j (DW^*)_{t-j} + \sum_{j=1}^{J} b_j P^*_{t-j} + E_t$	
(DW^*) does not Granger cause P^*		P^* does not Granger cause (DW^*)	
Ho: $b_j = 0$, $j = 1, 2, \ldots J$		Ho: $b_j = 0$, $j = 1, 2, \ldots J$	
Independent variables	P^*_{t-j}	$(DW^*)_{t-j}$	$(DW^*)_{t-j}$	P^*_{t-j}
Coefficients				
Lag 1:	0.7648		-0.37	
	(4.84)		(-1.57)	
	0.0164	0.7894	-0.44	-3.28
	(0.97)	(4.73)	(-1.88)	(-1.42)
R-square	0.5792	0.5994	0.1336	0.2364
F-computed value	0.41		0.72	

Note: All the coefficients are OLS estimations. The t-values are given in parenthesis below the coefficients.

Table 5.3 Causal relations between world inflation and overall domestic inflation in Saudi Arabian economy, 1963-83.

$P^*_t = a + \sum_{j=1}^{J} a_j P^*_{t-j} + \sum_{j=1}^{J} b_j (P^*_T)_{t-j} + U_t$		$(P^*_T)_t = a + \sum_{j=1}^{J} a_j (P^*_T)_{t-j} + \sum_{j=1}^{J} b_j P^*_{t-j} + E_t$	
(P^*_T) does not Granger cause P^*		P^* does not Granger cause (P^*_T)	
Ho: $b_j = 0$, j = 1, 2,. . . J		Ho: $b_j = 0$, j = 1, 2,. . . J	
Independent variables	P^*_{t-j}	$(P^*_T)_{t-j}$	$(P^*_T)_{t-j}$	P^*_{t-j}
Coefficients				
Lag 1:	0.7648 (4.84)	0	0.6135 (2.95)	0
	0.6237 (4.52)	0.5763 (3.1)	0.5707 (2.6)	
Lag 2:	0	0	0	0
Lag 3:				0.1631 (0.999)
R-square	0.5792 0.7408		0.3523 0.3859	
F-computed value	3.5**		0.41	

Note: All the coefficients are OLS estimations. The t-values are given in parenthesis below the coefficients.

**Significant at 5% level.

Table 5.4 Causal relations between overall domestic inflation and inflation generated from non-traded goods sector in Saudi Arabian economy, 1963-83.

$$P^*_t = a + \sum_{j=1}^{J} a_j P^*_{t-j} + \sum_{j=1}^{J} b_j (P^*_{NT})_{t-j} + U_t \qquad (P^*_{NT})_t = a + \sum_{j=1}^{J} a_j (P^*_{NT})_{t-j} + \sum_{j=1}^{J} b_j P^*_{t-j} + E_t$$

	(P^*_{NT}) does not Granger cause P^*		P^* does not Granger cause (P^*_{NT})	
	Ho: $b_j = 0$, $j = 1, 2, \ldots J$		Ho: $b_j = 0$, $j = 1, 2, \ldots J$	
Independent variables	P^*_{t-j}	(P^*_{NT})	(P^*_{NT})	P^*_{t-j}
Coefficients				
Lag 1:	0.7648	0	0.6522	
	(4.84)		(3.47)	
	1.0885		-0.2054	1.4032
	(7.47)		(-0.57)	(2.68)
Lag 2:		-0.3987		
		(-4.04)		
R-square	0.5792	0.7996	0.4295	0.6144
F-computed value	6.4**		2.6	

Note: All the coefficients are OLS estimations. The t-values are given in parenthesis below the coefficients.

**Indicates significance at 1% level.

overall domestic inflation P^*_t, and from P^*_t to (P^*_{NT}). A high value of the F-statistic, significant at the 1% level, indicates that the null hypothesis of no causation of overall domestic inflation from inflation generated in the nontraded goods sector is rejected. On the other hand, an insignificant F-statistic for the equation testing the hypothesis that overall domestic inflation causes inflation in the non-traded goods sector indicates that we fail to reject the null hypothesis of no such causal relationship exist (at the 1% level). However, at the 5% level, the F-statistic is close to being significant which implies some degree of feedback, which is in conformity with the current government policies.

Summary of Tests for Causality

Causality tests have been performed on the money supply, domestic inflation, world inflation, and inflation generated in the nontraded goods sector using bivariate autoregressive models. It has been found that no unidirectional causal relationship exist between excess supply of money and overall domestic inflation, or vice versa. However, our estimates show that an unidirectional causal relationship exists from world inflation to domestic inflation in Saudi Arabian Economy ($P^*_T \longrightarrow P^*_t$). Our estimates also suggest that some feedback relation may exist between domestic inflation and inflation generated in non-traded goods sector at 5% level ($(P^*_t)_t \longleftrightarrow (P^*_{NT})_t$.

CHAPTER VI

SUMMARY, POLICY IMPLICATIONS, AND CONCLUDING REMARKS

Summary

The objectives of the present study as mentioned in Chapter I are

1) To give a description of the most important macroeconomic variables in the Saudi Arabian economy.
2) To build a theoretical framework for analyzing the relationships between the following variables: foreign assets, the money supply, and domestic inflation in the Saudi Arabian economy.
3) To test the theoretical model empirically, and
4) To derive the policy implications of the study.

In this study, a theoretical model pertaining to the interrelations among foreign assets, money supply, and inflation in the Saudi Arabian economy has been developed. The model has then been tested empirically to ascertain its predictive power. The theoretical model and the empirical results can be summarized as follows:

A theoretical model has been presented to analyze and discuss the effect and the impact of external influences, domestic monetary disequilibrium (i.e., the discrapancy between money supply and money demand), and the domestic expectation of inflation (where agents take into consideration last year's inflation rate as the basis for expected inflation of the current year) on the rate of overall domestic inflation

of a small economy operating under a system of fixed exchange rates. In formulating the model, the unique and specific nature of the economy and economic institutions of Saudi Arabia have been duly incorporated. From the model, two basic equations (4.10 and 4.11) in Chapter IV have been derived to explain inflation in the nontraded goods sector (4.10) and overall domestic inflation (4.11) in the Saudi economy, with the inflation rates determined as functions of several explanatory variables such as excess supply of money, world inflation, and last year's rate of inflation.

In the empirical part of the study, the experience of Saudi Arabia between 1963 and 1983 has been divided into two distinct periods, 1963-72 (the period of the international oil companies' domination over oil production and pricing policies), and 1973-83 (the period of ownership transfer to the government of Saudi Arabia, and the years of oil price revolution). Before a direct test of the model was attempted, the demand for money was estimated. The analysis of the demand for money in Saudi Arabia reveals that variations in the level of real income (measured by the nonoil GDP explain a very high proportion of the observed changes in the real money holdings, independent of the inclusion of demand time deposits and quasi-money in the definition of money used. The estimated coefficient is highly significant when the narrowest definition of money is used (i.e., currency outside banks).

The empirical results show a weak relationship between the behavior of the excess supply of money and inflation in the Saudi economy (nontradables and overall domestic inflation) during the period of our study, 1963-83. The nontraded goods sector inflation rate (as measured by the rate of price change in the nontradable sector) is significantly

explained by external inflation (as measured by the rate of price change in the top ten trading partners in Saudi Arabian foreign trade) during the first period 1963-72, but not for the second period 1973-83, where the behavior of the inflation rate generated in the non-tradable sector is mainly explained by the last year's inflation rate, indicating that agent's expectation of inflation play an important role in determining the current inflation rate.

The equation for the overall domestic inflation rate in the first subperiod 1963-72 shows that overall domestic inflation is significantly explained by external inflation and is negatively related to the last year's inflation rate. During the second period, 1973-83, the picture is different. World inflation increased dramatically, and consequently, Saudi domestic inflation followed the same pattern. The rate peaked during 1974-77, and during subsequent years world inflation had a declining trend, and so did the Saudi inflation rate. The only independent variable statistically significant in explaining the behavior of overall domestic inflation is the last year's rate of inflation. It reflects the impact of expectation and the consequent behavior of the people toward inflation. A Chow-test conducted to test for structural shift in the economy indicates that no structural shift occurred during these two subperiods.

The causality test shows that no significant unidirectional causality exists between overall domestic inflation and the excess supply of money. But it shows a unidirectional causality relationship from the world inflation to Saudi Arabian overall domestic inflation which is significant at the 1% level. Another test was made to observe the relationship between overall domestic inflation and inflation

generated in the nontraded goods sector, and the result was a unidirectional causality from nontraded goods to overall domestic inflation at the 1% level of significance. But if we consider causality significant at the 5% level, it can be thought of as a feedback relationship.

Finally, it is hoped that the present study will help to illuminate and broaden the horizon of the existing literature on inflation in developing countries in general and in Saudi Arabia in particular. Of course, the relevance and importance of the present study are more apparent for those economies having structural characteristics akin to Saudi Arabia. Due to the paucity of disaggregated data, the present study could not utilize monthly or quarterly data. Further research can fruitfully utilize the model with the help of disaggregated data for further investigation.

Policy Implications

Before mentioning the policy implications of the present study, it is worth reiterating that Saudi Arabia has a unique economic system where oil revenue accrues directly to the government and not to the private sector. This, itself, is a departure from the tradition of the Western economic sytem. It makes, to some extent, the prevailing balance-of-payment theories inapplicable to the monetary policies in the Saudi economy. The international reserve inflow to Saudi Arabia does not become monetized until the government undertakes net domestic expenditures. What has been mentioned by Heller about the mechanism by which increases in reserves generate an increase in the monetary base does not necessarily apply to the Saudi economy, because the increase in

reserves is generated through the public sector revenues from exports and not via the private sector.

Implications from the preceeding empirical analysis for future improvements in policymaking decisions aimed at dealing with inflationary pressure from within and from outside may not be difficult to deduce.

The empirical results show a weak relationship between the money supply and domestic inflation. This, in fact, can be related first to the nature of the economy itself where the government's cash flow spending is the major source of increase in the money supply. For this reason, and given the freedom from all restrictions on foreign exchange transfers, the role of monetary policy has been limited in scope. On the other hand, the government can directly intervene to determine the supply of money, since no money market operates actively in the economy. The lack of influence of excess supply of money on domestic inflation may be also related partially to the high growth of productivity and real income. This might have outweighed the increase in money supply. But whatever may be the reason--because of the country's particular institutions and accounting rules--the economic system is taking care of this source of inflation.

The world inflation rate had its influence on the Saudi economy particularly during the early 1970s, since the Saudi Arabian economy is one of the most open economies in the world. But during the late 1970s and the early 1980s world inflation slowed down, and so did the Saudi inflation. At the same time, additional economic measures were taken by the government of Saudi Arabia. The impact of external inflation on the national economy helped to reduce the domestic inflation. The policies

followed by the government of Saudi Arabia to ease the inflation pressure includes providing infrastructral facilities and offering subsidies to some growing sectors of the economy including the necessary goods sector. These policies achieved the goal of decreasing the domestic inflation rate. But the question that can be raised regarding this policy is: Does it make sense to continue extending subsidies without any specific set of criteria, and specific time horizon? Some convincing and sound economic reasons should be declared before providing any kind of subsidy, since subsidy imposes a net loss to the society. Incentives and facilities should be provided to the productive sectors of the economy and, in the context of Saudi Arabia, mainly to the agricultural and industrial sectors. These would enable them to grow faster and to reach the level of necessary competitivness within a specific time in order to make a greater contribution to the growth of the nonoil GDP, and hence, real income in order to counter the inflation rate.

It seems that a large portion of the inflation in the nontraded goods sector originated from high investment in housing construction. A policy of deceleration in capital expenditures in the housing construction sector, and reallocation of those funds in the other productive sectors, will improve the overall performance of the economy. This may reduce the prospect of inflation generated through this housing sector, as well as inflation generated through other sources.

For the nontraded goods, the empirical results show that it has a unidirectional causality toward the overall domestic inflation (at a 1% level of significance). This result confirms to some extent the policy of providing infrastructral facilities and subsidies in protecting this

sector from external influences. At the same time, it can influence domestic inflation as a whole. In the early years of 1980s the government relaxed some of its policies regarding subsidies, and that is reflected in the feedback relationship (at the 5% level) between inflation in the nontraded goods sector and overall domestic inflation. It is time to establish competitiveness in different sectors of the economy. A system of material incentives and motivation policies should be introduced based on productivity criteria, in order to make the economy more efficient and to maximize the total social welfare through the minimization of the reliance on the government.

Concluding Remarks

This study emphasized that the Saudi Arabian economy is a unique system where not all the prevalent economic theories are totally applicable. This is particularly so for balance of payments theories related to foreign reserves, money supply, and inflation. This as shown is due in part to the unique nature of the economic institutions of the economy and the economic philosophy of the state.

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APPENDICES

Appendix A

Table 5-5. Estimated real demand for money in Saudi Arabian economy, 1963-83 (in billions of Saudi riyals).

$m^d = \theta(y)$ where: y = nonoil (GDP) in real term

$m^d = \theta_0 + \theta 1\ y$

$m^d = -2.1528 + 0.7446\ y$

$R^2 = 0.998$ DE = 1.74 F = 4605.5

Year	Real nonoil (GDP)	Estimated demand for money m^d	% rate of growth in m^d m^{*d}
1963	4.70	1.3562	--
1964	5.10	1.6549	22.0248
1965	5.61	2.0356	23.0044
1966	6.03	2.3492	15.4058
1967	6.61	2.7822	18.4318
1968	6.96	3.0435	9.3918
1969	7.37	3.3496	10.0575
1970	7.59	3.5139	4.9051
1971	8.04	3.8499	9.5620
1972	8.61	4.2754	11.0522
1973	9.72	5.1042	19.3853
1974	11.18	6.1942	21.3550
1975	12.63	7.2768	17.4776
1976	14.90	8.9915	23.2891
1977	17.69	11.0546	23.2191
1978	20.13	12.8763	16.4791
1979	22.52	14.6606	13.8572
1980	25.19	16.6541	13.5977
1981	28.33	18.9984	14.0764
1982	31.50	21.3651	12.4574
1983	33.77	23.0599	7.9326

Source: SAMA, Annual Reports, various issues, 1971-84.

Table 5-6. The annual rates of change in Saudi Arabian money supply components, 1963-83.

Year	Money supply multiplier (a)	% change in a a*	Foreign assets (FA)	Government deposits (GD)	Base money B = FA - GD	% change in B B*	% change in money supply $M^{S*} = a^* + B^*$
1963	1.3136	-3.6526	2.35	1.26	1.09	36.2500	32.5974
1964	1.3410	2.0859	2.68	1.49	1.19	9.1743	11.2602
1965	1.3168	-1.8046	3.40	1.96	1.44	21.0084	19.2038
1966	1.3485	2.4074	3.66	1.95	1.71	18.7500	21.1574
1967	1.3417	-0.5043	4.25	2.44	1.81	5.8480	5.3437
1968	1.3174	-1.8111	3.92	1.83	2.09	15.4696	13.6585
1969	1.2999	-1.3284	3.53	1.09	2.44	16.7404	15.4180
1970	1.2965	-0.2616	4.02	1.39	2.63	7.869	7.5253
1971	1.2066	-6.9341	6.95	3.65	3.30	25.4753	18.5412
1972	1.3112	8.6690	11.99	8.26	3.73	13.0303	21.6993
1973	1.2295	-6.2309	16.99	11.89	5.10	36.7292	30.4983
1974	1.2784	3.9772	78.19	44.92	33.27	552.3529	556.3301
1975	1.2247	-4.2006	136.54	89.54	47.0	41.2684	37.0678
1976	1.3636	11.3416	180.84	125.15	55.69	18.4894	29.8310
1977	1.3084	-4.0481	208.27	133.75	74.52	33.8122	29.7641
1978	1.1906	-9.0034	198.95	112.98	85.97	15.3650	6.3616
1979	1.4642	22.9800	207.46	110.37	97.09	12.9347	35.9147
1980	1.7258	17.8664	290.75	185.11	105.64	8.8063	26.6727
1981	1.9200	11.2528	439.88	329.13	110.75	4.8372	16.0900
1982	1.8398	-4.1771	484.22	344.19	140.03	26.4379	22.2608
1983	1.8694	1.6089	463.49	329.38	134.11	-4.2227	-2.6138

Source: International Financial Statistics, various issues, 1982-84.

Table 5-7. The growth rate of excess supply of money in Saudi Arabian economy, 1963-83.

Year	% change in (M^S) $M^{*S} = a^* + B^*$	% change in (m^d) m^{*d}	Excess supply of money (W*)	D(W*)[1]
1963	32.5974	--	--	--
1964	11.2602	22.0248	-10.7646	--
1965	19.2038	23.0044	-3.8006	75.4055
1966	21.1574	15.4058	5.7516	58.9664
1967	5.3437	18.4318	-13.0881	-73.8348
1968	13.6585	9.3918	4.2667	251.0858
1969	15.4180	10.0575	5.3605	4.5074
1970	7.5253	4.9051	2.6202	-10.8054
1971	19.5412	9.5620	8.9792	28.112
1972	21.6993	11.0522	10.6471	5.7555
1973	30.4983	19.3853	11.1130	1.5202
1974	556.3301	21.3550	534.9751	168.374
1975	37.0678	17.4776	19.5902	-92.8663
1976	29.8310	23.2891	6.5419	-32.9584
1977	29.7641	23.2191	6.5450	0.0117
1978	6.3616	16.4791	-10.1175	-62.7708
1979	35.9147	13.8572	22.0575	325.5755
1980	26.6727	13.5977	13.0750	-21.3577
1981	16.0900	14.0764	2.0136	-33.4434
1982	22.2608	12.4574	9.8034	35.3863
1983	-2.6138	7.9326	-10.5464	-68.2801

[1]Add (20) to all figures; (W*) before calculating D(W*).

Source: International Financial Statistics, various issues, 1982-84.

Table 5-8. The weighted average share of the top ten trading partners in Saudi Arabian tradable good's prices, 1963-83.

Year	Japan	USA	France	Italy	United Kingdom	Germany	Nether-land	Spain	Belgium	Singa-pore	Canada	Bahrain	Brazil	Price of traded goods
1963	7.8950	18.5603	1.716	3.337	6.37	4.7902	2.2231	0.0689	--	--	0.5658	--	--	45.5263
1964	7.7371	18.5603	1.794	3.479	6.5	4.6788	2.3265	0.065	--	--	0.5658	--	--	45.7065
1965	7.7371	19.3501	1.794	3.408	6.63	4.7902	2.3265	0.0689	--	--	0.5781	--	--	46.6829
1966	7.7371	19.745	1.872	3.337	6.89	4.9016	2.3265	0.0715	--	--	0.6027	--	--	47.4957
1967	8.0529	20.1399	1.833	3.337	6.89	4.9016	2.3265	0.0754	--	--	0.615	--	--	48.1713
1968	10.6386	16.354	2.6179	3.3135	6.575	4.862	2.565	0.1705	1.5024	--	--	0.2784	--	48.8773
1969	11.0558	16.983	2.6736	3.4545	6.7065	5.083	2.565	0.1674	1.565	--	--	0.2784	--	50.5322
1970	11.473	17.612	2.7293	3.5955	7.2325	5.304	2.736	0.1674	1.6589	--	--	0.2784	--	52.7870
1971	12.0988	18.241	2.8964	3.807	7.7585	5.746	2.85	0.1736	1.6276	--	--	0.2958	--	55.4947
1972	13.559	18.87	3.2306	4.23	8.416	6.5195	3.135	0.1953	1.8467	--	--	0.3306	--	60.3327
1973	21.0756	21.406	2.5992	3.983	8.2715	8.2198	3.9396	0.2508	2.8324	--	--	--	0.079	72.6569
1974	27.02	27.2162	3.0324	5.0641	10.019	9.9088	5.2332	0.3135	3.5696	--	--	--	0.100	91.4768
1975	27.02	30.58	3.61	5.69	11.65	11.26	5.88	0.33	3.88	--	--	--	0.100	100.00
1976	20.4732	30.6425	5.3704	8.9676	9.7	14.0148	5.6762	1.0296	2.93	1.2546	--	--	--	100.0589
1977	22.5412	31.8325	5.754	10.2078	11.2	15.3888	6.2944	1.1648	3.1937	1.3776	--	--	--	108.9548
1978	26.884	34.2125	6.576	11.3526	13.5	17.7245	7.025	1.1856	3.6625	1.5375	--	--	--	123.6603
1979	34.5137	35.698	9.9802	13.5135	14.3008	19.7246	5.4908	3.066	3.2465	--	0.95	--	--	139.6291
1980	37.245	40.6408	11.2008	15.876	17.6144	21.2107	6.2328	3.4164	3.612	--	1.1096	--	--	158.1585
1981	39.4797	44.4852	9.8366	14.6475	12.2773	18.3736	5.7505	3.0121	3.096	--	1.1552	--	--	152.1137
1982	36.6684	45.3595	8.9059	12.6830	11.4293	17.1617	5.0014	2.8410	2.5638	--	1.1519	--	--	143.7659
1983	35.8511	46.058	8.5943	11.1701	10.7638	16.4340	4.6739	2.5121	2.0123	--	1.1439	--	--	139.2135

Source: International Financial Statistics, various issues, 1982-84.

Direction of Trade Annual, various issues, 1968-84.

Table 5-9. The annual rate of changes in Saudi domestic prices and in world prices, 1963-83.

Year	Nonoil (GDP) deflator • nontraded goods (P_{NT})	Rate of growth in (P_{NT}) (P^*_{NT})	Consumer price index P	Rate of growth in (P) P*	World price price of traded goods (P_T)	Rate of growth in (PT) (P^*_T)
1963	39.69	--	42.70	--	45.5263	--
1964	40.05	0.9070	43.90	2.8103	45.7065	0.3958
1965	40.73	1.6979	44.10	0.4556	46.6829	2.1362
1966	41.98	3.0690	44.80	1.5873	47.4957	1.7411
1967	42.75	1.8342	45.70	2.0089	48.1713	1.4224
1968	43.96	2.8304	46.50	1.7505	48.8773	1.4656
1969	45.76	4.0946	48.10	3.4409	50.5322	3.3858
1970	44.90	-1.8794	48.20	0.2079	52.7870	4.4621
1971	46.07	2.6058	50.30	4.3568	55.4947	5.1295
1972	47.91	3.9939	52.50	4.3738	60.3327	8.7179
1973	52.67	9.9353	61.20	16.5714	72.6569	20.4271
1974	61.97	17.6571	74.30	21.4052	91.4768	25.9024
1975	100.00	61.3684	100.00	34.5895	100.000	9.3173
1976	142.61	42.6100	131.60	31.6000	100.0589	0.0589
1977	171.80	20.4684	146.50	11.3222	108.9548	8.8907
1978	196.81	14.5576	144.20	-1.5700	123.6603	13.4969
1979	213.79	8.6276	147.00	1.9417	139.6291	12.9134
1980	233.36	9.1538	152.40	3.6735	158.1585	13.2704
1981	249.35	6.8521	156.10	2.4278	152.1137	-3.8220
1982	262.69	5.3499	157.87	1.1339	143.7659	-5.4879
1983	273.15	3.9819	159.46	1.0072	139.2135	-3.1665

Source: International Financial Statistics, various issues, 1982-84.

SAMA, Annual Reports, various issues, 1971-84.

Appendix B

Mathematical Derivation of Equation 1

$$M^d = P \times m^d$$

$$\ln M^d = \ln(P \times m^d)$$

$$\ln M^d = \ln P + \ln m^d$$

$$\frac{d(\ln M^d)}{dt} = \frac{d(\ln P)}{dt} + \frac{d(\ln m^d)}{dt} .$$

Let

$$\frac{d(\ln M^d)}{dt} = M^{*d}$$

and

$$\frac{d(\ln P)}{dt} = P^*$$

and

$$\frac{d(\ln m^d)}{dt} = m^{*d} ,$$

then

$$M^{*d} = P^* + m^{*d} .$$

Mathematical Derivation of Equation 3

We follow the same procedures as in equation 1 above.

$$M^s = (a \cdot B)$$

$$\ln M^s = \ln(a \cdot B)$$

$$\ln M^s = \ln a + \ln B$$

$$\frac{d\ln M^S}{dt} = \frac{d\ln a}{dt} + \frac{d\ln B}{dt}$$

$$M^{*S} = a^* + B^* .$$

Mathematical Derivation of Equation 5

$$P = P_T^Z \cdot P_{NT}^{(1-Z)}$$

$$\ln P = \ln(P_T^Z \cdot P_{NT}^{(1-Z)})$$

$$\ln P = \ln P_T^Z + \ln P_{NT}^{1-Z}$$

$$\frac{d\ln P}{dt} = Z\frac{\ln P_T}{dt} + (1-Z)\frac{\ln P_{NT}}{dt}$$

$$P^* = ZP^* + (1-Z)P^*_{NT} .$$

Mathematical Derivation of Equation 7

$$\frac{P_{NT}}{P_T} = ne^{\delta E}$$

$$\ln\left(\frac{P_{NT}}{PT}\right) = \ln n + \delta E$$

$$\ln P_{NT} - \ln P_T = \ln n + \delta E$$

$$\frac{d\ln P_{NT}}{dt} - \frac{d\ln P_T}{dt} = 0 + \delta\frac{dE}{dt}$$

$$P^*_{NT} - P^*_T = \delta\frac{dE}{dt} .$$

Mathematical Derivation of Equation 10

$$(P^*_{NT} - P^*_T)_+ = \delta[D(a^* + B^* - P - m^{*d})_+] \ .$$

Applying the D operator to P*, we write:

$$(P^*_{NT} - P^*_T)_+ = \delta[D(a^* + B^* - m^{*d})_+] - \delta P^*_+ + \delta P^*_{t-1}$$

$$(P^*_{NT} - P^*_T)_+ = \delta[D(a^* + B^* - m^{*d})_+] - \delta[ZP^*_T + (1-Z)P^*_{NT}]_+ + \delta P^*_{t-1} \ .$$

$$(P^*_{NT} - P^*_T)_+ = \delta[D(a^* + B^* - m^{*d})_+] - \delta Z(P^*_T)_+ - \delta(P^*_{NT})_+ + \delta Z(P^*_{NT})_+ + \delta P^*_{t-1}$$

$$(P^*_{NT} + \delta P^*_{NT} - \delta ZP^*_{NT})_+ = \delta[D(a^* + B^* - m^{*d})_+] + (P^*_T)_+ - \delta Z(P^*_T)_+ + \delta P^*_{t-1} \ .$$

$$(1 + \delta - \delta Z)\ (P^*_{NT})_+ = \delta[D(a^* + B^* - m^{*d})_+] + (1-\delta Z)\ (P^*_T)_+ + \delta P^*_{t-1}$$

$$[1 + (1-Z)\delta]\ (P^*_{NT})_+ = \delta[D(a^* + B^* - m^{*d})_+ + (1-\delta Z)\ (P^*_T)_+ + \delta P^*_{t-1}$$

$$(P^*_{NT})_+ = \frac{\delta}{1 + (1-Z)\delta} \cdot [D(a^* + B^* - m^{*d})_+] + \frac{1 - \delta Z}{1 + (1-Z)\delta} \cdot (P^*_T)_+ + \frac{\delta}{1 + (1-Z)\delta} \cdot P^*_{t-1} \ . \ . \ .$$

Mathematical Derivation of Equation 11

From equation 5, we obtain

$$P^* = ZP^*_T + (1-Z)P^*_{NT} \ .$$

Using equation 10, then,

$$P^*_t = Z(P^*_T)_t + (1-Z)\,(P^*_{NT})_t = (ZP^*_T)_t + (1-Z)\left[\frac{\delta}{1 + (1-Z)\delta} \cdot [D(a^* + B^* - m^{*d})_t] + \frac{1 - \delta Z}{1 + (1-Z)\delta} \cdot (P^*_T)_t + \frac{\delta}{1 + (1-Z)\delta} \cdot P^*_{t-1}\right]$$

$$P^*_t = Z(P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot [D(a^* + B^* - m^{*d})_t] + \frac{(1-Z)(1-\delta Z)}{1 + (1-Z)\delta} \cdot (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} P^*_{t-1}$$

$$P^*_t = \left[Z + \frac{(1-Z)(1-\delta Z)}{1 + (1-Z)\delta}\right] (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} [D(a^* + B^* - m^{*d})_t] + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot P^*_{t-1}$$

$$P^*_t = \frac{[Z\{1 + (1-Z)\delta\} + (1-Z)(1-\delta Z)]}{1 + (1-Z)\delta} (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} [D(a^* + B^* - m^{*d})_t] + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot P^*_{t-1}$$

$$P^*_t = \frac{Z + \delta Z - Z^2\delta + 1 - Z - Z\delta + Z^2\delta}{1 + (1-Z)\delta} \cdot (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} [D(a^* + B^* - m^{*d})_t] + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot P^*_{t-1}$$

$$\pi_t(1) = P^*_t = \frac{1}{1 + (1-Z)\delta} (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot [D(a^* + B^* - m^{*d})_t] + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot (P^*_{t-1}) ,$$

when we assume $(a^* + B^* - m^{*d}) = W^*$, then

$$\pi_t(1) = P^*_t = \frac{1}{1 + (1-Z)\delta} (P^*_T)_t + \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot (D^*W^*)_t$$

$$+ \frac{(1-Z)\delta}{1 + (1-Z)\delta} \cdot (P^*_{t-1}) \quad . \; . \; .$$

---

[1]Overall domestic inflation.

Chow Test

One technique for testing the equality of two regressions is the Chow test, which considers the availability of the necessary data for two periods to see if there is change in the response of the dependent variable to the independent variable between the two periods. Consider the following regressions:

$$\text{Period I:} \quad Y_{1t} = \alpha_1 + \beta_1 X_t + U_{1t} \qquad t = 1, 2, \ldots 9 \qquad (1)$$

$$\text{Period II:} \quad Y_{2t} = \alpha_2 + \beta_2 X_t + U_{2t} \qquad t = 1, 2, \ldots 10 , \qquad (2)$$

where Y and X are the dependent variable and the independent variable respectively, and where the subscripts 1 and 2 on the variables refer to the two periods. To find out whether the two regressions differ, either in the intercepts or slopes, or both, Chow outlines the following steps:

Step I: Combine all the N_1 and N_2 observations of the two periods and run the following single "pooled" regression (Note: in the present study, $N_1 = 9$ and $N_2 = 10$)

$$Y_t = \alpha + \beta X_t + U_T .$$

From this regression, we obtain the residual sum of squares (RSS), say SSE with df = $N_1 + N_2 - k$, where k is the number of parameters estimated.

Step II: Run the two individual regressions (1) and (2) and obtain their RSS, say SSE_1 and SSE_2, with df = $N_1 - k$ and $N_2 - k$, respectively.

Step III: Apply the F test as follows:

$$F = \frac{[SSE - (SSE_1 + SSE_2)]/k}{(SSE_1 + SSE_2)/N_1 + N_2 - 2k}$$

with df = k, $N_1 + N_2 - 2k$. If the computed F exceeds the critical F, reject the hypothesis that the two regressions are the same (Gujarati, 1978).

Appendix C

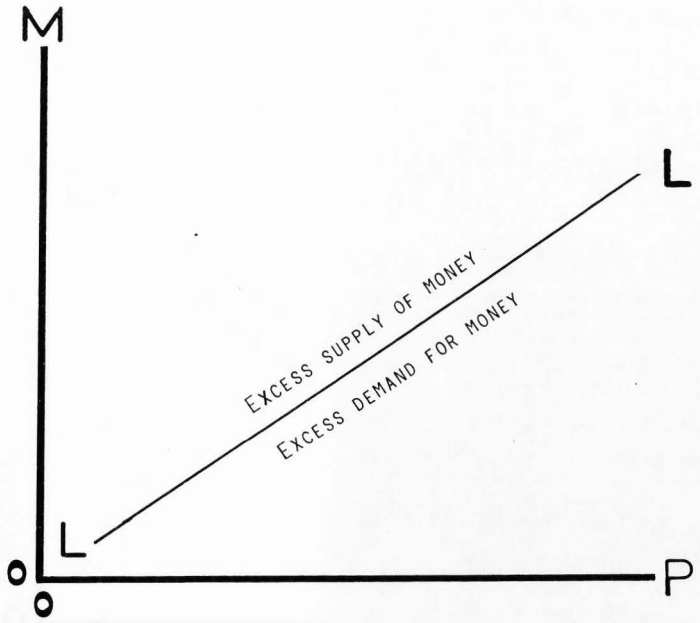

Figure 1.a. The LL schedule.

[On the LL line, expenditure = income, M is the quantity of money, and P is the domestic price level of home produced goods. Any point to the right of LL implies an excess demand for money and any point to the left of LL implies an excess supply of money.]

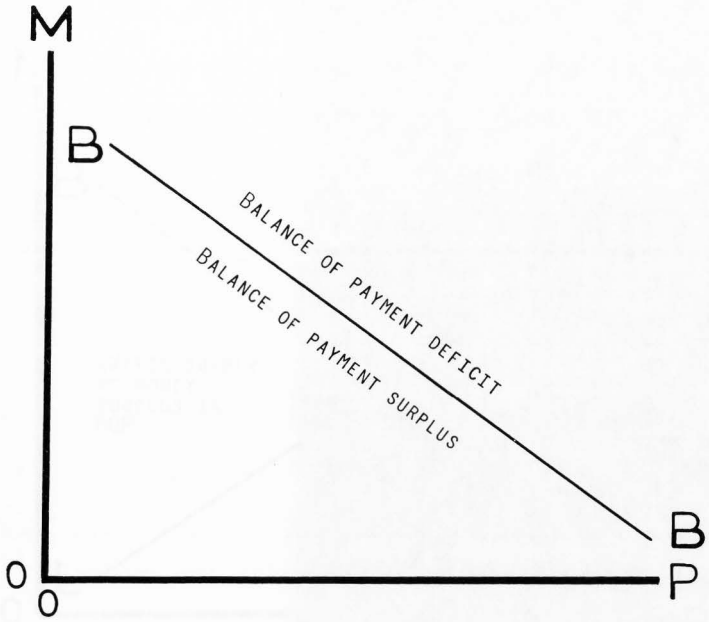

Figure 1.b. The BB schedule.

[On BB line balance of trade is in equilibrium. Any point above BB represents a deficit in BOP and any point below represents a surplus in BOP.]

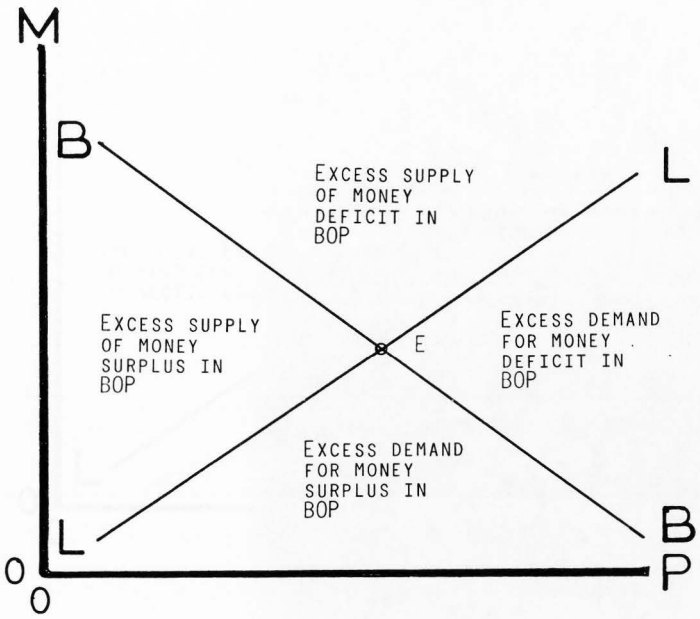

Figure 1.c. Interaction between LL and BB schedule.

[At E, income is equal to expenditure and demand for money is equal to supply of money, i.e, BOP is balanced.]

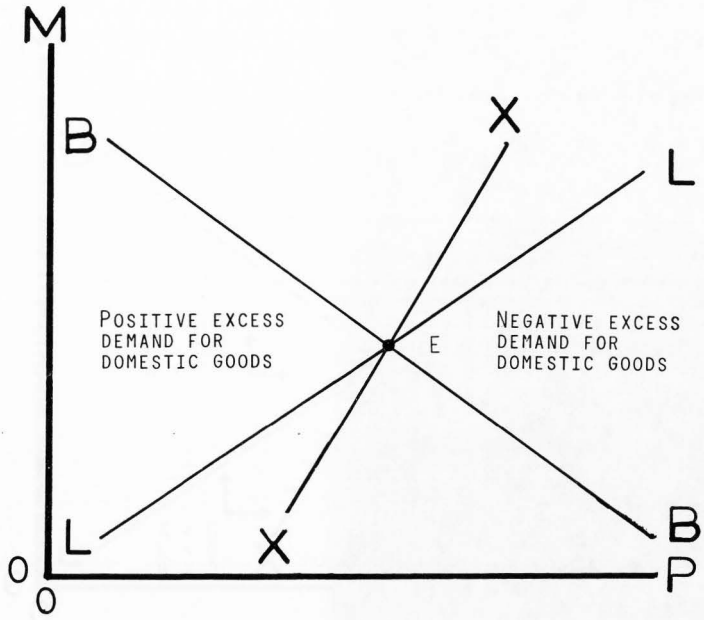

Figure 2.a. Positive and negative excess demand for domestic goods.

[On XX schedule, $X = E + B - Y$. At point E, $Y = E$, $M^d = M^s$, and $X = B + B - Y$.]

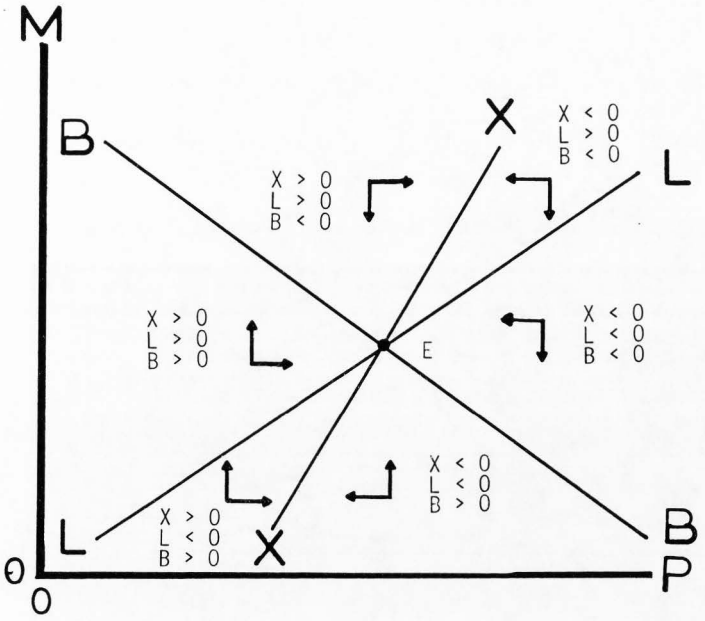

Figure 2.b. Phase path of adjustment of M and P.

[Perpendicular arrows in different regions indicate the direction of the path of adjustment of M and P with respect to different combinations of X, L, and B.]

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