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A macroeconometric model for the economy of Saudi Arabia

Saleh Ahmed Tawi
Iowa State University

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Saleh Ahmed Tawi

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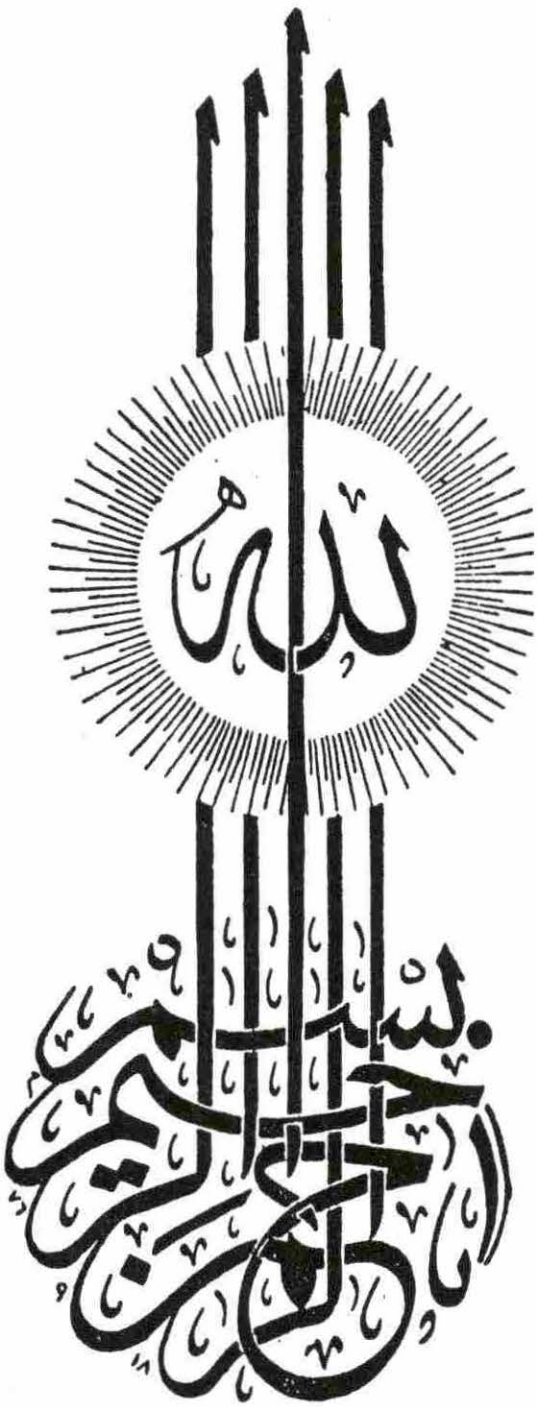
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INTRODUCTION

The purpose of this study is to construct a macroeconometric model for the Saudi Arabian economy. The study is restricted to commodity market which includes consumption, investment, government revenue and external trade sectors. The sectoral analysis in general consists of a brief review of the theoretical literature, some characteristics of the Saudi economy in each sector, the data used and the definitions of variables used in each sector, as well as specification and estimation of sectoral equations.

The thesis is divided into eight chapters. After an introduction of the study, Chapter 1 presents the general observations about the economic development in Saudi Arabia. Chapter includes the procedure of specification and the estimation procedure used. Chapter 3 describes the Saudi Arabian system of national accounts. Chapter 4 examines the consumption functions of the economy. A distinction is made between private and public consumption because the oil revenues are owned by the government and hence do not go to the private sector directly. Chapter 5 examines the investment function. No distinction is made between public and private investment because of both the lack of sufficient data and the heavy government role in investment. Chapter 6 deals with the government revenue function and Chapter 7 with the foreign trade sector, which includes the imports and exports of Saudi Arabia. No estimate was made for the export function because the oil export, the only export product, is subject to factors other than economics. Political as well as economic factors, on one hand, and the characteristics of the

international oil demand, on the other, make it difficult to relate the exports of Saudi Arabia with the influence of traditional factors, such as the income of oil importing countries and the price of oil relative to their domestic prices. Chapter 8 presents the conclusions.

CHAPTER 1. GENERAL OBSERVATIONS ABOUT THE ECONOMIC DEVELOPMENT IN SAUDI ARABIA

The Saudi Arabian economy suffered severe problems before the country started to export oil in commercial quantities in 1938. The government's main source of income was limited to customs duties on imports and fees paid by pilgrims to the holy cities of Macca and Madena. The private sector was also very poor. People depended on very small scale activities in agriculture, fishing and trading. There was no industrialization, but the economy was self-sufficient in terms of providing its food needs from limited domestic agriculture.

Modernization of the economy began in different sectors with the export of oil in larger quantities in the late 1940s. In the early 1960s, implementing a national development plan for the country became important. However, it was not until 1970 that the Central Planning Organization began the first five year development plan.

In 1957, United Nations involvement provided technical training and know-how and/or supervisory assistance for Saudi economic development projects.[1] The Economic Development Committee (EDC) was established in 1958 to implement the country's development plan. Finally, in 1975, the Central Planning Organization (CPO) became the Ministry of Planning. The beginning for formal economic planning in Saudi Arabia dates to 1970. Prior to that, planning responsibilities were poorly defined, and much time and effort was directed to secondary functions. In addition, the

[1]Abdulaziz Daghistani, "Economic Development in Saudi Arabia: Problems and Prospects," Ph.D. dissertation, University of Houston, 1979, p. 45.

lack of reliable data and insufficient administrative and technical personnel hindered the formation of sound development plans.[2]

In 1973, Saudi Arabia gained strong powers of international finance in recognition of the characteristics of world oil demand and the high level of Saudi oil production, coupled with the dramatic increase in oil prices.

During the period of the first and second development plans (1970-1980), the annual growth rate of GDP in current prices averaged 26 percent. The real annual growth rate of GDP during the same period was 10 percent, the same as that projected by the two plans (Table 1.1).

Table 1.1. Gross domestic product and its rate of growth (1970-1980) (million Saudi Riyals)[a]

Year	GDP at current prices	Rate of growth	GDP at constant prices of 1970	Rate of growth
1970	17399	--	17399	--
1971	22921	0.24	19907	0.13
1972	28257	0.28	22963	0.13
1973	40551	0.30	27495	0.16
1974	99315	0.59	31642	0.13
1975	139510	0.28	31723	0.003
1976	164526	0.15	34461	0.08
1977	205056	0.20	39668	0.13
1978	225400	0.09	42028	0.06
1979	249539	0.10	44838	0.06
1980	385807	0.35	49424	0.09
Average		0.26		0.10

[a]Sources: National Accounts of Saudi Arabia, Central Department of Statistics, Ministry of Finance and National Economy, Riyadh, Saudi Arabia, issues 1981, 1982; SAMA Annual Report, Riyadh, Saudi Arabia, issue 1973.

[2]Said Martan, "Domestic Development and the Management of Oil Revenues in the Economy of Saudi Arabia," Ph.D. dissertation, University of Nebraska, Lincoln, Nebraska, 1980, pp. 52-53.

Oil plays an important role in the growth rate of GDP, averaging 49 percent of the total for the period 1970-1982. Manufacturing's share in GDP was 9.6 percent in 1970, dropping to 6.8 percent in 1982. However, the construction sector registered a high rate of growth, with a total GDP share increase from 5.4 percent in 1970 to 11.5 percent in 1982 because of the emphasis planners have put on this sector in the two development plans, by which most of the other development goals could be accomplished easily. However, agriculture's sectoral share in the GDP dropped almost every year. In 1970, agriculture claimed a 5.7 percent share of the total GDP, but this was only 3.4 percent in 1982 (Table 1.2). The lack of water for irrigation purposes and the high percentage of illiteracy among farmers, in addition to the low return rate for the agricultural sector relative to others, are among the causes of this decline.

The general rate of development is always limited by a shortage of production factors, especially capital, in most developing nations.[3] However, this does not apply to Saudi Arabia for at least the next several years to come. In Saudi Arabia, the most needed production factor is labor. About two million members of the Saudi Arabian labor force come from abroad.[4]

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[3]Gerald Meier, Leading Issues in Economic Development, Oxford University Press, New York, 1976, p. 252.

[4]From Al-Mubtaath Magazine, Nov. 6, 1983, published monthly by the Saudi Arabian Educational Mission in the U.S., 1983, p. 47.

The following are general characteristics of an oil economy:

(1) Though the petroleum sector makes an important contribution to the national product, it employs a negligible proportion of the economy's labor force (less than 1 percent in Saudi Arabia).

(2) A major if not overwhelming proportion of the government's expenditure is financed from oil revenues (more than 90 percent in Saudi Arabia).

(3) The nonpetroleum sector acts as a price-taker in the market for its imports.

(4) There is full employment in the economy.[5]

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[5]The Basic Macro-Economics of Oil Economies, a paper written by M. Shahid Alam, Associate Professor, Applied Economics Research Center, University of Karachi, 1982, p. 1.

Table 1.2. Relative shares of groups of economic activity in total GDP at constant prices of 1970[a]

Year	Total GDP	Oil[b]	Agri-cul-tur-al	Manu-fac-tur-ing	Elec-tricity, gas and water	Con-struc-tion	Govern-ment serv-ices	Others
1970	100	47	5.7	9.6	1.6	5.4	11.1	19.6
1971	100	50	5.1	9.2	1.5	4.8	10.3	19.1
1972	100	54	4.6	8.1	1.4	4.6	9.5	17.8
1973	100	57	4.0	7.2	1.4	5.1	8.5	16.8
1974	100	58	3.6	6.6	1.3	5.5	8.2	16.8
1975	100	55	3.7	6.4	1.0	7.8	8.3	17.8
1976	100	51	3.5	6.3	1.0	9.6	8.6	20.0
1977	100	50	3.2	6.2	1.0	10.4	8.0	21.2
1978	100	47	3.5	6.4	1.3	10.9	7.6	23.3
1979	100	45	3.5	6.6	1.6	10.5	7.7	25.1
1980	100	44	3.3	6.5	1.8	10.4	7.3	26.7
1981	100	43	3.3	6.5	2.1	10.6	7.8	26.7
1982	100	38	3.4	6.8	2.6	11.5	7.8	29.9

[a]Sources: National Accounts of Saudi Arabia issues, 1981, 1982; SAMA Annual Report, issue 1973.

[b]Not including petroleum refining.

CHAPTER 2. PROCEDURE OF SPECIFICATION

Introduction

Four factors should be borne in mind in the process of selecting the best econometric model for our case. These are: (1) the appropriate theoretical bases; (2) the features or characteristics of the Saudi economy; (3) the appropriate statistical bases in terms of the estimator and statistical tests; and (4) the appropriate data base. Sometimes these four conditions can be met simultaneously and hence, a consistent, reliable outcome may be reached. However, in many cases, conflict occurs and researchers should be very careful in deciding which specifications are to be selected. The rise of different features and characteristics in the developing economies hinders the application of available economic theories, unless some modifications are applied. Such modifications should reflect the features of the economy. Otherwise, misleading results might occur. On the other hand, the specifications of the sectoral equations should meet the traditional statistical tests to ensure the statistical dimension is not violated. However, certain statistical factors may require specifications differing from those stated in economic theory. In such a case, the statistical base decision may be shown incorrect, if one brings to it reasonable justification backed with sound bases in theoretical economies.

Estimation Procedure

The ordinary least squares estimation procedure (OLS) has been applied in our study. However, it is noted that this procedure yields

the best linear unbiased estimators (BLUE) if the following assumptions are fulfilled. These assumptions in matrix notation are:

1. $E(u) = 0$ (all u_is have mean equal to zero) where u is a parameter vector of the unobserved residual;

2. $E(uu') = \sigma^2 I_n$. There are actually two strong assumptions embodied in this:

   a. The homeoscedasticity assumption, which means that u's have a homogeneous variance; and

   b. The u's are uncorrelated or independent.

Pooling a and b yields a variance/covariance matrix of the u's having homogeneous values (the variance of the u's) along its diagonal elements, and zero elsewhere.

3. $E(uX) = 0$, meaning that the u's are independent of X;

4. X is a matrix of fixed values, measured without errors;

5. Rank of X is $P + 1$, and $n > P + 1$.

This means that no exact linear relationship exists among the $P + 1$ columns of X. Also, we need more observations (n) than the parameters $(P + 1)$ we have to estimate.

However, a violation of any of the above assumptions will influence the precision of the estimates and hence, lead to unreliable results. In our study, the above assumptions were made. However, various tests were applied to ensure that such assumptions are reasonably reliable even if they cannot be met exactly. Therefore, transformations have been applied to the original data, as in the case of the presence of autocorrelation, so that the estimation procedure could

reliably produce efficient, unbiased estimates. The following tests were applied.

Testing for the Autocorrelation Problem

The OLS procedure embodies the important assumption that independency exists among errors associated with different observations. Under some circumstances, this assumption breaks down; therefore, the assumption that $E(u'u) = \sigma^2 I_n$ no longer holds. The circumstances which violate this assumption are: (a) The relationship between the dependent and the independent variables is wrongly specified. Most autocorrelation problems are due to the incorrect specification of a regression equation. The influence of an omitted variable(s) will be captured as a component of the error term, which makes the error term move in a certain direction, correlating the errors over time. Serial correlations in individual omitted variables need not necessarily imply a serially correlated disturbance term, for individual components may cancel one another out. However, if the serial correlation in the omitted variables is pervasive, and if the omitted variables tend to move in phase, then there is a real possibility of an autocorrelated disturbance term.[1] (b) A disturbance term may also contain a component due to measurement error in the explanatory variable. This, too, may cause serial correlation in the composite disturbance.[2] Positive or negative autocorrelation may take place, depending on the direction of

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[1] J. Johnston, Econometric Methods, McGraw-Hill Book Company, New York, 1972, p. 244.

[2] Ibid., p. 244.

correlation among errors over time.

If an autocorrelation problem exists in a regression equation, the consequences will be: (a) Regression estimators will be unbiased but inefficient, because they lack minimum variance. In other words, the standard error of regression will be biased downward (even if the estimators are unbiased). This may lead one to believe that the parameter estimates are more precise than they actually are.[3]

The most widely used test for autocorrelation is the Durbin-Watson test. However, it is appropriate only for a relatively large sample, as the Durbin-Watson table begins with samples of 15 or more observations. There are many shortcomings in connection with this test, although attempts have been made to make it more powerful in detecting autocorrelation problems. In the inconclusive region, there is no clear-cut test for detecting autocorrelation because the sequence of residuals is influenced by the movement of independent variables in the regression. The apparent correlation of the errors in this region may be due to the autocorrelation of the independent variable and not to the serial correlation of the error terms.[4] There are four necessary assumptions for the DW statistic to be valid:

(1) Assume fixed X matrix (no lagged dependent variable as a regressor);

(2) DW test is a test for first order serial correlation; i.e., only for the hypothesis

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[3]Robert Pindyck and Daniel Rubinfeld, Econometric Models and Economic Forecasts, McGraw-Hill Book Company, New York, 1981, p. 153.

[4]Ibid., p. 159.

$$H_0 : E[u_t \; u_{t-1}] = 0$$

$$H_A : E[u_t \; u_{t-1}] \neq 0$$

(3) In the case of small samples, DW requires the normality of the u_ts; and

(4) DW tables assume that regression includes a column of ones; i.e., a constant term.

Therefore, this test is not appropriate to an equation having a lagged dependent variable as a regressor. An alternative test was developed by Durbin to overcome the problem of having a lagged dependent variable as a regressor, but it still needs a large sample size for valid testing. This test is a large-sample test (n>30); nothing is known about its small-sample properties.[5] However, according to Pindyck and Robinfeld, this alternative test provided by Durbin is strictly valid for large samples of data and can be used for small samples as well.[6]

A correction for the autocorrelation is suggested to obtain an efficient estimate. There are several methods of transformation, of which the best-known are the Cochrane-Orcutt procedure, the Hildreth-Lu procedure, and the Durbin procedure. All procedures are valid for first order autocorrelation problems only. The lack of more disaggregated data in our study, as it is in most of the LDCs, leads to the unavailability of having enough data to include some variables which, we

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[5] J. Johnston, Econometric Methods, McGraw-Hill Book Company, New York, 1972, p. 313.

[6] Robert Pindyck and Daniel Rubinfeld, Econometric Models and Economic Forecasts, McGraw-Hill Book Company, New York, 1981, p. 194.

believe, are important. This leads to the omission of some relevant variables from the regression and hence leads to the existence of the autocorrelation problem. On top of that, we are dealing with time series data in which the existence of autocorrelation is more likely than it is in the cross-sectional data. Using the SAS package, a correction for autocorrelation was applied to some of the equations whenever it was possible in the present analysis. It is hoped that this correction solves the problem, since we have only a small sample size (12 observations). This deprives us of the large sample size properties in terms of the statistical test and the procedure for correcting for the autocorrelation. I should mention also that in the case of having lagged dependent variables, we did not attempt correction; finding, instead, that it wasn't worth reporting, we decided to leave it as it is, hoping for more observations in the future to make this test more valid.

Multicollinearity Problems

The assumption of having no exact linear relationship among the independent variables in the model is crucial to the OLS procedure. Two kinds of multicollinearity violate this assumption:

(1) Exact multicollinearity; i.e., $|x'x| = 0$ and hence $(x'x)^{-1}$ is undefined, meaning that an estimate of regression coefficients will not be obtained. Once the exact relationship among regressors is identified and one of the collinear variables in the model is eliminated, the problem is solved.

(2) Near multicollinearity arises when two or more variables (or a combination of variables) are highly (but not perfectly) correlated with each other.[7] This reduces the precision of estimates and might lead to specification errors.

The main consequences of multicollinearity are to reduce the precision of estimates. This presents a problem if a variable(s) ought to be in a model but cannot be accepted due to a low t-ratio leading to reduced reliability of estimates.[12] Changing the data set may be a solution, if the problem is created as a result of a poor data base and if another set of data is available. This kind of problem has been present in most of the regression equations in this study. However, except for being aware of its existence in selecting appropriate variables to incorporate in sectoral equations, nothing was done in respect to it.

Statistical Tests

Standard statistical tests were applied in this study to determine the best specification. Sometimes the tests provided no clear-cut answer; therefore, econometricians used their own judgment, experience, and feelings about the data at hand to select specifications.

The statistical tests applied in our study are $\bar{R}^2$, T, DW, and F statistic.

R-squared explains how much variability in the dependent variable

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[7] Ibid., p. 88.

[8] Ibid., p. 89.

can be explained by changing in the independent variables. One should use adjusted R-squared ($\bar{R}^2$) in order to avoid the effects of the number of regressors on the regular R-squared (R^2). Adjusted R-squared is defined as:

$$\bar{R}^2 = 1 - (1 - \bar{R}^2) \frac{N - 1}{N - k} ,$$

where:

N is the sample size; and

k is the number of independent variables.

Also, one should interpret this statistic carefully. If the model does not contain an intercept, the R^2 given by the computer output should be modified by using the SS corrected total instead of the SS uncorrected total used in calculating R^2, as reported in the computer output. The F statistic is usually used as a test for the null hypothesis, which states that all coefficients of the regression except for the intercept are equal to zero. If the null hypothesis is rejected, at least one of the regressors is significant.

The T statistic is a test showing that one of the independent variables has no significant influence upon the dependent variable. If the null hypothesis cannot be rejected, the corresponding regressor has no influence on the dependent variable.

Assessing the Normality of the Residual Term

This assessment can be performed with either the modified Shapiro Wilk test statistic or the Rankit Plot, in graphical language.

Rankit Plot

Given the hypothesis that data have arisen from a normal distribution, several graphical techniques may be used in its analysis. One of the best for small, ungrouped samples is the Rankit Plot.[9] Rankits are defined as the average (expected) values of the N ordered observations for a random sample of size N from the standard normal population.[10] If we draw a sample of size N from a standard normal population ten times, taking the smallest value from each set of size N, and divide that by 10, we should get m_1, which is plotted against the smallest value in our data sample. This procedure continues until we get a series ranging from m_1 (the smallest) to m_N (the largest). Plotting the Rankit values ($m_1 \ldots m_N$) against the sample observations, after rearranging them from the smallest to the largest, results in an approximately straight fitted line. This conclusion is derived from the notion that when taking a sample from a normal distribution, ranking the observations in this manner yields certain values which, on the average, one would expect each of the ranked observations to attain.[11] Denoting the ordered sample observations by $X_{(1)}, X_{(2)}, \ldots, X_{(N)}$ where $X_{(1)} \leq X_{(2)} \ldots \leq X_{(N)}$ and the Rankit values from its constructed table by $m_{(1)}, m_{(2)}, \ldots, m_{(N)}$ where

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[9] Christopher Bingham, "A Graphical Aid to Assessing the Normality of Data," University of Minnesota. Revised by Kenneth Koehler, Dept. of Statistics, Iowa State University, October 1980, p. 1.

[10] Ibid., p. 2.

[11] Ibid., p. 1.

$m_{(1)} \leq m_{(2)} \cdots \leq m_{(N)}$ yields a plot of Xs against ms, with an approximately straight fitted line because each of the Xs has an expected value equal to m_i where i is the simultaneous rank of observed and Rankit values.[12] This means the following points should be plotted:

$$(X_1, m_1), (X_2, m_2), \ldots, (X_N, m_N) \quad .$$

In a perfect case, X_i should exactly equal m_i, with the resulting fitted line just a straight line. However, in most situations, that is not the case; the plotted points instead will scatter in different shapes around a straight line. Therefore, the more these plotted points can form an approximately straight line, the greater the chance of having a normal distribution of data. If the two variables form a curved relationship, one should suspect errors in the model which will require further steps.

Shapiro Wilk test

The null hypothesis for the Shapiro Wilk test is that,

H_0: the data came from a normal population, against the alternative hypothesis,

H_A: Not H_0.

The correlation coefficient between the ordered data and the Rankits (expected ordered statistics from a standard normal distribution) should be strong enough to conclude the normality of the data studied. The statistic which represents this relationship is:

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[12] A table for the Rankit values is provided for each sample size.

$$W = \left[\frac{\sum_{i=1}^{N} (X_{(i)} - \bar{X})(m_i - \bar{m})}{\sum_{i=1}^{N} (X_{(i)} - \bar{X})^2 \sum_{i=1}^{N} (m_i - \bar{m})^2} \right]^2 = \frac{\left[\sum_{i=1}^{N} (X_{(i)} - \bar{X})(m_i - \bar{m}) \right]^2}{\sum_{i=1}^{N} (X_{(i)} - \bar{X})^2 \sum_{i=1}^{N} (m_i - \bar{m})^2}$$

Reduced and simplified, the W statistic shows that:

$$W = \frac{\text{Cov. } (X, m)}{\text{Var. } (X) \cdot \text{Var. } (m)}$$

This is a simple correlation coefficient. The value of W ranges from zero (if no correlation exists) to 1 (if the relationship is deterministic). A standard table exists for testing the probability of W. Both procedures above were applied by testing the residual component's normality.

CHAPTER 3. DESCRIPTION OF SAUDI ARABIA SYSTEM OF NATIONAL ACCOUNTS (SANA)[1]

The preparation of national accounts in Saudi Arabia is undertaken by the Central Department of Statistics, Ministry of Finance and National Economy. The definitions and classifications in current national accounts in Saudi Arabia are going according to the revised U.N. System of National Accounts 1968 (SNA).

Official statistics on national accounts were prepared for the first time in 1968 by the Central Department of Statistics (CDS). They consisted of Gross Domestic Products (GDP), Gross National Products (GNP), and national income, at current and constant prices, based on the former system of National Accounts of the United Nations. The new SNA of the United Nations has been applied in 1973.

Present Status of National Accounts

It consists of the following tables and accounts:

(a) Gross Domestic Product by kind of economic activity in producers' values at current prices;

(b) Domestic factor income by kind of economic activity at current prices;

(c) Gross Domestic Products by kind of economic activity in producers' values at constant prices;

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[1]This description has been abstracted from the following sources: (1) Outline of the National Accounts of Saudi Arabia, Central Department of Statistics, Ministry of Finance and National Economy, Riyadh, December 1981; (2) National Accounts of Saudi Arabia, Central Department of Statistics, Ministry of Finance and National Economy, December 25, 1982.

(d) Government final consumption expenditure according to cost compensation and purpose in purchaser's values, at current prices;

(e) Private final consumption expenditure in purchaser's values at current prices;

(f) Final consumption expenditure in the domestic market at current prices by object;

(g) Compensation of gross fixed capital formation by type of capital goods, in purchaser's values, at current prices;

(h) External transaction;

(i) Supply and disposition of goods and services at current prices;

(j) Gross Domestic Product and expenditure in purchaser's values at current prices; and

(k) National income.

Most of the data begin from 1966-67 and are related to Hejra fiscal years. A Hejra fiscal year covers the twelve month period from the beginning of the seventh month of the Hejra calendar.

Sources and Methods

We will present here the sources and methods of constructing each of the above accounts.

(1) Gross Domestic Products by kind of economic activity in producers' values at current prices. This table is based on SNA Table 1 and distinguishes between two types of producers: (a) industries and other producers except government services, and (b) producers of government services. GDP in the first category is classified according to the kind of economic activity based on the ISIC (International Standard

Industrial Classification) as recommended in the SNA. The second category is divided into (i) public administration and defense, and (ii) other services. Gross domestic product is estimated mainly through the production approach.

Petroleum activities account for over 50 percent of total GDP and include extraction of crude oil, manufacturing (refining of crude oil), construction, domestic marketing, transportation, oil exploration and community services by oil companies. GDP arising from these activities is included in the appropriate kind of economic activity and is calculated mainly from data given in the annual returns supplied to the CDS by the oil companies. Sales of crude oil and refined products are valued at realized prices and not at published.

Gross output and GDP for producers of government services are obtained from a classification of government final consumption expenditure according to cost-compensation and purpose which is present as a separate table (Table 4). This classification shows figures of compensation of employees, intermediate consumption and final consumption. Producers of government services cover central government ministries and departments, municipalities and departments with independent budgets but exclude enterprise departments, e.g. railway and Saudi airlines, which are included under industries data on expenditure by central government ministries and departments and are taken from final accounts of the government published annually. For municipalities and departments with independent budgets, the annual estimates of expenditure shown in their budgets are used, after making appropriate adjustments

for under expenditures, since their final accounts are not published.

For activities outside the petroleum and government sector, the main sources of data are the surveys of establishments, conducted by the CDS. They provided figures of gross output and intermediate consumption from which GDP was calculated for the following activities: Other manufacturing (except petroleum refining); electricity, gas and water; construction other than government and oil companies construction; wholesale and retail trade; restaurant and hotels; storage, finance; insurance; real estate and business services (except commercial banking and ownership of dwellings). The surveys of establishments covered only the main cities in the Kingdom. The figures were suitably adjusted to take account of activities in the small cities and villages.

Estimates for the following activities not covered by the survey of establishments mentioned above are calculated as follows:

(a) Agriculture and fishing.

(i) Crops. The results of agricultural surveys conducted by the Ministry of Agriculture and Water provided figures of quantities produced and wholesale prices. Gross output was estimated by multiplying figures of quantities produced with figures of estimated farm prices. The latter was calculated using wholesale prices less margins for trade and transport. Calculation of intermediate consumption was based on studies on cost of production carried out by the National Accounts section of the Central Department of Statistics.

(ii) Livestock and livestock products. This category includes

breeding of camels, cows, sheep, goats, poultry and production of dairy products and eggs. The data needed for calculating gross output were obtained from the Ministry of Agriculture and Water and the data for intermediate consumption from studies on cost of production conducted by the Agricultural College of the University of King Saud.

(iii) Fishing. Gross output was estimated by multiplying quantity data with estimated producers' prices. Quantity data were provided by the Ministry of Agriculture and Water. Producers' prices were estimated using retail prices of fish, adjusted for trade and transportation. In regard to intermediate consumption, this was estimated using the relationship between gross output and intermediate consumption obtained from studies on cost of production.

(b) Electricity, gas and water. The figures needed for calculating gross output and intermediate consumption for electricity were provided by Electricity Companies, for gas by the National Gas and Manufacturing Company, and for water by the Water Departments in their annual statements of revenue, expenditure and capital formation to the Central Department of Statistics. In regard to the water distributed by establishments other than water departments, the necessary data were obtained from Establishments Survey of the C.D.S.

(c) Mining activities (outside petroleum) are largely limited to the extraction of sand, stone and gravel for construction and no

satisfactory data on revenues or costs are available on these activities. Their contribution to total GDP is relatively small. GDP in mining was estimated by taking a percentage of GDP in construction and gross output was estimated by taking a percentage of GDP in mining. These percentages are based on investigations made on mining activities.

(d) Construction. Estimates of GDP for construction were calculated by multiplying figures of gross output with certain coefficients based on studies carried out for this purpose. Gross output is divided into three segments: (1) government financed construction, (2) construction by government enterprises, and (3) other construction.

(e) Transport (NOA-government). Figures of GDP in road transport were calculated from estimates of the number of vehicles in use and average income from different kinds of vehicles. To obtain gross output, the relationships between gross output and intermediate consumption calculated from the results of CDS Surveys of Establishments were used. This category includes estimates for water transport, airport and sea services for which gross output and intermediate consumption were calculated from data obtained from CDS Establishments Survey. In addition are included estimates for Tapline, calculated from statements on revenue, expenditure and capital formation provided by this company annually to the CDS.

(f) Transport and communications, government enterprises. This includes national airline and railway. Gross output and GDP for

these were calculated from annual returns sent by them to the CDS giving details of revenue, expenditure and capital formation. Also included in this category are posts, telephone and telecommunications services for which gross output and GDP were calculated from details of their revenue and expenditure obtained from accounts of the government.

(g) Ownership of dwellings. Benchmark figures were obtained from the results of the household expenditure survey in 1977 conducted by the CDS. To obtain an estimate of the other years, the benchmark figures were multiplied by an index of growth, calculated from available data on house construction.

(h) Inputted bank service changes. The results of commercial banking operations conducted by the Saudi Arabia Monetary Agency (SAMA) for a certain year enable the CDS to calculate benchmark figures of GDP for inputted bank service charges. These were multiplied by an index of banking services to obtain figures for other years.

(2) Domestic factor incomes by kind of economic activity at current prices. This table is a continuation of SNA Table 1. It shows domestic factor incomes including consumption of fixed capital by kind of economic activity. This is calculated by deducting from GDP, net indirect taxes. Much of the data on indirect taxes and subsidies are obtained from the Ministry of Finance, but some figures relating to profits and losses of certain government enterprises, which are regarded as indirect taxes or subsidies of these enterprises. This table also shows a breakdown of domestic factor incomes under

compensation of employees and operating surplus. Figures of compensation of employees are obtained directly in the case of oil companies and government enterprises from their returns to the CDS, and in the case of government services from the classification of final accounts of government and budget estimates of municipalities and departments with independent budgets. For other activities, GDP is multiplied by ratios of compensation of employees to GDP to obtain the relevant estimates. These ratios are based on the results of the Survey of Establishments referred to earlier and other special studies on this subject. Operating surplus, including consumption of fixed capital, is the difference between domestic factor incomes and compensation of employees. Due to lack of data, consumption of fixed capital has not been calculated. This is, therefore, included in domestic factor incomes and operating surplus.

(3) Gross Domestic Product by kind of economic activity at constant price of 1969/70. This table is based on SNA Table 9. It shows a breakdown of GDP at constant prices classified under the same categories as in the table on GDP at current prices, discussed above. The figures are calculated in detail, either by multiplying the GDP figures for the base year 1969/70 by a quantity index base 1969/70-100, or by deflating the GDP series at current prices by a price or wage index, 1969/70-100. The quantity index method is used in the case of agriculture. Extraction of crude petroleum, petroleum refining, other manufacturing, electricity, gas, water, rail and air transport, and community, social and personal services and government services, the

price index method is used for other sectors.

(4) Government Final Consumption Expenditure according to cost composition and purpose in purchaser's value, at current prices. This table is based on SNA Table 4. It has 4 columns: Compensation of employees, intermediate consumption, other outlays less noncommodity sales and commodities produced, and final consumption expenditure. The total of each case column is classified according to the purpose categories recommended in SNA Table 4.

This table is prepared by classifying and aggregating current expenditures of (a) central government ministries and departments, (b) municipalities, and (c) departments with independent final accounts of the government prepared annually.

(5) Private Final Consumption Expenditure at current prices. This is reproduced from the table on supply and disposition of goods and services discussed below.

(6) Private Final Consumption Expenditure in the Domestic Market by object. This table is based on the results of the consumer expenditure survey in 1977 which provided expenditure data classified by object estimates of population based on the census of population (1974) were also used in this calculation. This is a new series introduced in 1979 and is available for 1977/78 and 1978/79 only.

(7) Compensation of gross fixed capital formation by type of capital goods at current prices. This is based on SNA Table 7a. Gross fixed capital formation is classified according to residential building construction, transport, equipment and machinery, and equipment. Each

of these categories is further classified under government sector, non-oil private sector and oil sector.

(8) External Transactions. This table is based on SNA Table 27. Due to lack of data on capital transactions, it shows only figures of current transactions. The principal sources of data for this table are the Balance of Payments statements prepared by the SAMA. Data on merchandise exports and imports are taken from records of the CDS which is responsible for preparing foreign trade data.

(9) Exports and Imports of Services. Exports of services consist of earnings by the national airline from operation outside the country, receipts from foreign ships and aircrafts calling at the country's ports, expenditure by foreign missions in Saudi Arabia, by nonresident workers employed in the country, and by nonresident Haji Pilgrims. Imports of services consist of personal expenditure abroad, tourism, education, medical treatment and the like by residents and services purchased abroad by resident companies and government departments. These estimates are based on data provided by SAMA.

(10) Supply and disposition of goods and services. This table distinguishes between (a) goods and services produced by industries, producers of nonprofit services to households and domestic services of households; and (b) other goods and services. Category (a) is classified according to kind of activity as in Table 1. Category (b) consists of government services, direct purchases abroad by government services, direct purchases abroad by resident households less direct by non-purchases households in the domestic market.

It is assumed that every industry produces goods and services which are characteristic to that industry. Using this assumption, gross output is entered in column 1 of the above table relating to domestically-produced goods and services in producers' value. Column 2 of this table shows imports of goods and services c.i.f. These data are taken from the table on external transactions discussed above and a classification of foreign trade statistics prepared by the CDS according to ISIC. Column 3 shows import duties. These figures are calculated from data on customs, tariffs and import values. The next column shows transport and distribution margins. For crude petroleum and petroleum products, this is calculated from data supplied to the GDS by oil companies in their annual returns. For other products, this is calculated using margins available for different categories of goods from studies carried out by CDS. The aggregates of columns 1-4 are shown in column 5, i.e., total supply and disposition.

The next step is to allocate total supply of goods and services for each kind of activity under the various intermediate and final demand categories. Information is drawn from a variety of sources for this calculation. A classification of imports and domestic production according to consumer, intermediate and capital goods is used in determining the initial allocation of supply to private final consumption expenditure. The details of inputs in the Survey of Establishments, annual returns of oil companies, and government enterprises are used in allocating figures to intermediate consumption, industries. Details of expenditure given in accounts of government municipalities and

departments with independent budgets are used in determining the allocation to intermediate consumption, producers of government services. The allocation to exports f.o.b. is based on the classification of exports according to ISIC categories and other data used in preparing the Table External Transactions. Details of capital formation from previous calculations are used in allocating figures to Gross Fixed Capital Formation. Data on changes in stock are available for agriculture, crude oil and petroleum products only. Changes in stocks of other goods are estimated residually. This includes errors and omissions.

In the category Other Goods and Services, the figure of government services is allocated to the final demand column, Government Final Consumption and Expenditures. Direct purchases abroad by government services available fromt he tables on external transaction are allocated to "intermediate consumption, producers of government services." Direct purchases abroad by resident households and direct purchases by nonresident households in the domestic market are available from the table on External Transaction; the difference between these two is allocated to private final consumption expenditure.

(11) Gross Domestic Product and Expenditure at Current Prices. This is based on SNA Account 1. The first three items, compensation of employees, operating surplus, and net indirect taxes, are available from the calculations of GDP and domestic factor incomes discussed earlier. The balance items relate to imports of goods and services and final expenditure which are available from table on Supply and

Disposition of Goods and Services discussed above.

(12) National Income. This is based on SNA Table 18a. The various component items of this table are available from previous calculations. Compensation of employees, operating surplus, domestic factor incomes and net indirect taxes are available from the table on Gross domstic Product and Expenditure, compensation of employees from the rest of the world, net, and property and entrepreneurial income from the rest of the world, net, are available from the table on External Transactions.

National Accounting Problems

Saudi Arabia's experience in national accounts has been limited so far to preparing data dealing with production and supply and use of resources. Due to lack of basic data, it has not been possible to prepare data on income, outlay and capital finance.

Difficulties have been experienced in adopting the various types of standard classifications. In regard to classification of producers, it has been possible to classify them into two types only: producers of government services and all other producers. Also, certain government agencies qualify in some respects to be classified as industries, while in other respects they could be classed as producers of government services. Accounts of government ancillary activities, which produce goods and services for sale in the market, are not available separately and can't be properly classified. Other difficulties experienced in the government sector concerned separating current from capital expenditure, including separating current repairs from capital repairs in

construction, distinguishing between subsidies and transfers, classifying producers of government services by kind of activity, government consumption by purpose, capital expenditure by different types of capital goods. These problems are mainly the result of lack of detail in the government accounts and other administrative records. In all these instances, "rule of thumb criteria" have been established in preparing the classifications.

CHAPTER 4. PRIVATE CONSUMPTION FUNCTION

The total consumption expenditure in Saudi Arabia constituted an average of about 39 percent of the Gross Domestic Product (GDP) during the period 1970-81. On the average, .44 percent of total consumption was private.[1] Since a tremendous amount of oil revenues flooded into the country, one would expect oil revenues to be a major determinant of the private consumption function. However, in Saudi Arabia that is not the case. In his book, The Structural Econometric Model of the Saudi Arabian Economy, Faisal Al-Bashir writes[2]:

> The recent and sudden wealth of Saudi Arabia is derived from income from oil which is owned exclusively by the government and foreign oil companies. Therefore, construction of the consumption function must reflect the phenomenon that the public sector of the country is wealthy but that the majority of the population is as poor as most other LDCs.

This suggests that there should be a distinction made between determinant(s) of the private consumption function and the public or governmental consumption function. We should recognize that this book was written about seven years ago, and the observation that the majority of the population is as poor as most other LDCs is too hard to conclude nowadays. This doesn't mean that there is no poverty among Saudis, but to compare it with other LDCs today is not fair. However, the conclusion of the distinction is still held since oil revenues influence

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[1] SAMA Annual Report, various issues.

[2] Fisal Al-Bashir, A Structural Economic Model of the Saudi Arabian Economy: 1960-1970, John Wiley and Sons, New York, 1977.

the people's income indirectly. Another empirical study also confirms this. In his study, "The Contribution of Oil Exports to Economic Development: A Study of the Major Oil Exporting Countries," Kader[3] concluded:

$$\overset{\circ}{Y} = 10.10 - 0.009\ e, \quad S.E. = (0.0023)$$

$$R^2 = 0.51$$

where:

$\overset{\circ}{Y}$ = the rate of growth of per capita income; and

e = the value of oil revenue per capita.

The low regression coefficient explains how much the per capita income growth rate ($\overset{\circ}{Y}$) depends on changes in the per capita values of oil revenues. The negative sign of the regression coefficient indicates that the domestic economy in the countries studied was unable to absorb rapidly rising oil earnings.[4] At the same time, Kader obtained the following results for Saudi Arabia alone:

$$\overset{\circ}{Y} = 13.135 - 0.171\ \overset{\circ}{e} \quad S.E. = (0.160)$$

$$R^2 = 0.125$$

where:

$\overset{\circ}{e}$ = the growth rate of e.

The R^2 is very low (0.125), and the sign of the regression coefficient reflects that $\overset{\circ}{e}$ is the wrong variable to select. Kader concluded that

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[3]A. A. Kader, "The Contribution of Oil Exports to Economic Development: A Study of the Major Oil Exporting Countries." The American Economist: The Journal of the International Honor Society in Economics 24, No. 1 (1980):48-49.

[4]The countries are Iraq, Saudi Arabia, Iran, Kuwait, Libya and Venezuela.

this small association between the $\mathring{Y}$ and e (or $\mathring{e}$) variables is partly the result of lags and fluctuations of actual expenditures from actual revenues in the countries of study.

In another study, Mukhtar observed[5]:

> The limited capacity of the oil industry for employment due to its being a very high capital intensive industry is an important reason for the oil industry employs less than one percent of the labor force in Saudi Arabia, despite the fact that its value added accounts for more than 90 percent of the GDP.

Therefore, one should distinguish between two consumption functions in Saudi Arabia, i.e., the private and public consumption expenditure functions.

Private Consumption Behavior in Saudi Arabia

National income accounts of Saudi Arabia divide total consumption into two main parts, private and public (or government). Al-Ali and Jammal,[6] in a more detailed study of private consumption behavior in Saudi Arabia (1982), selected two sector classifications: the 12-sector national income account classification used by Central Department of Statistics (CDS) and the 31-sector input-output classification used by the Ministry of Planning. The following has been drawn from their research. An estimate of aggregate consumption function for commodity groups according to the above sector classification was made. It was

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[5]Balool Mukhtar, "Economic Analysis of the Long-Term Planning Investment Strategies for the Oil Surplus Funds in Saudi Arabia: An Optimal Approach," Ph.D. dissertation, University of Houston, Houston, Spring, 1981, pp. 208-209.

[6]Hashim M. Al-Ali and Yahya M. Jammal, "Private Consumption Pattern in the Saudi Arabian Economy," Research Department, National Planning, Ministry of Planning, Riyadh, January, 1982.

found that the consumption (dependent) variable used in each function is an individual's expenditure for a certain commodity. The total expenditures for all goods and services (independent variable) was used as a proxy for the income variable. Other independent variables (i.e., the price of the commodity in question, the price of substitutes, etc.) were excluded from analysis. The main reason for exclusion was the one common to all LDCs, a lack of data. The commodity groups were subdivided by geography (rural vs. urban) and population category (Saudis vs. non-Saudis).[7] The general form of the function relationship was:

$$\ln C_{ijk} = a_{ijk} + b_{ijk} \ln Y_{ijk} + e_{ijk}$$

where:

$i = 1, \ldots, n$, $j = 1$ (urban), 2 (rural), and $k = 1$ (Saudi), 2 (non-Saudi); and

e_{ijk} = the error term.

Since the equation was in log form, the following is a justification for the different elasticities. Al-Ali and Jammal found that elasticities (where the coefficients of the log form represent the change in consumption due to a change in income) differ according to commodity group, geographical area, and population category. General conclusions from this study are: Since income elasticities differ among commodity groups, geographical locations, and population categories, government policies will not consistently affect the country's population. The government can take measures that, through their effects on income, benefit a certain portion of the population more than another. Given its policy

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[7] For more details on the collection procedure, see Al-Ali and Jammal.

priorities, these benefits depend on the relative size of income elasticity (see Table 4.1).

Al-Ali and Jammal's study uses the total consumption expenditure as a proxy for personal income. However, as they said, that assumption has weaknesses: The regression coefficient (R^2) will be overestimated due to the high correlation of dependent (total expenditure on a specific commodity group) and independent variables; more importantly, to have a meaningful marginal propensity to consume (MPC) with more accurate values for income elasticities of demand, one must allow for savings. MPC figures are meaningless for comparing Saudis vs. non-Saudis if the non-Saudis save most of their income. Therefore, one needs two sets of MPC, one of Saudis, the other for non-Saudis, in order to obtain meaningful results.

Some suggest the need for two consumption functions in the private sector. In both quantity and quality, the labor force is the scarcest factor of production. The country relies heavily on foreign labor. A 1967 survey of Saudi Arabian businesses showed that foreign workers accounted for about 50 percent of the total labor force in some sectors.[8] Therefore, a labor bottleneck stands in the way of achieving a satisfactory growth rate which meets national planning goals.

According to the second development plan (1975-1980), there were 314,000 foreign workers in the country in 1975, although other observers believe the figure to be closer to 1.5 million.[9] Since 1975, the number

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[8]Fisal Al-Bashir, A Structural Econometric Model of the Saudi Arabian Economy: 1960-1970, John Wiley and Sons, New York, 1977.

[9]Richard Nyrop, Area Handbook for Saudi Arabia, U.S. Government Printers, Washington, D.C., 1977, p. 236.

Table 4.1. Summary of the elasticities of different commodities in different locations (rural vs. urban) and different groups (Saudis vs. non-Saudis)

Commodity	Elasticity				Justification
	Rural vs. urban		Saudis vs. non-Saudis		
Agricultural Commodities	(0.81)	(0.77)	(0.76)	(0.76)	The share of these commodities to total consumption is higher in the basket of rurals. Residents of urban areas usually consume a wider range of commodities, whereas consumers in rural areas tend to spend most of their income on food and agricultural products.
Textiles	0.77	1.03	0.97	1.13	
Food	0.72	0.75	0.72	0.80	
Manufactured Products	0.83	1.08	1.09	1.03	One would expect consumption of durable goods (the main item in this group) for permanent residents of a country to be more income-sensitive. Foreigners will not alter their consumption of durables once they have purchased them. The textile industry seems to be an exception to this pattern, probably because of the attractiveness of the Saudi market to non-Saudis. The Saudi market provides a wide range of these goods at internationally competitive prices.
Electricity	0.62	0.73	0.68	0.76	The limited use of electricity in rural areas explains their low income elasticity relative to urban centers. The more frequent use of electrical equipment by non-Saudis, especially those coming from countries with higher living standards, explains the difference

In general, inelastic with lower income

Saudis seem to have higher elasticities than non-Saudis except for food and textiles.

In general, inelastic with more sensitivity

	elasticity in non-rural centers.		Saudis group.		between Saudis vs. non-Saudis.
Water	0.62 In general, inelastic.	0.59	0.57 In general, inelastic.	0.49	The low income elasticity in non-Saudis may be attributed to a standard of water consumption that they are used to and very reluctant to alter. Most urban dwellers do not consume much city water. They use bottled water and the water use investigated in this study is that of the city water provided. It does not include bottled water.
Services:					
Household repairs	0.93	1.38	1.28	0.70	Services in general are elastic in urban areas and inelastic in rural areas, except for health services, which are inelastic in both. In the cities, services such as home repairs, social and community services, health and property ownership are basic to non-Saudis; i.e., they need to have them regardless of their income level and that is why these elasticities are low.
Social and community services	0.98	1.10	1.12	0.93	
Health	0.83	0.92	0.97	0.70	
Property ownership	0.68	0.99	0.98	0.93	

of foreign workers has continued to increase. Some observers placed it close to 3 million by the end of 1979. About two million members of the Saudi Arabian Labor force came from abroad in 1983.[10] One possible reason for the discrepancy of estimates is that Yemenis and other Arabs were not included in the official figures.[11]

Therefore, a distinction between two types of private consumption function is urgently needed. There should be one for Saudis and another for non-Saudis, since the non-Saudis' avowed purpose is to save as much money as possible. Given this high percentage of foreigners relative to the total population of the country, this figure is rather important and must be considered to adequately explain the difference between the marginal propensities to consume of Saudis vs. non-Saudis.

A better aggregate consumption will result if one includes the income of both groups as regressors against the private consumption. Data for income and consumption of "foreigners-only" are not discriminated, so one can use only private sector consumption and income as a whole. Therefore, one must be very careful in interpreting the coefficients of the estimated aggregate function.

Data

The following define the variables used in estimating the private consumption function:

PC_t = Current total Private Consumption Expenditure

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[10] Al-Mubtaath Magazine, Nov. 6, 1983, p. 47.

[11] Said Martan, "Domestic Development and the Management of Oil Revenues in the Economy of Saudi Arabia," Ph.D. dissertation. University of Nebraska, Lincoln, Nebraska, 1980.

PC_{t-1} = Total Private Consumption Expenditure lagged one year

PY_t = Current Personal Disposable Income

PY_{t-1} = Personal Disposable Income lagged one year

PY_{t-2} = Personal Disposable Income lagged two years

PY_{t-3} = Personal Disposable Income lagged three years.

Private Consumption Expenditure is available in many government publications. However, Personal Disposable Income is not available in Saudi Arabia's national income accounts and must be calculated. Therefore,

Personal Disposable Income = National Income minus Direct Taxes[12] minus Net Transfers to the Rest of the World[13] plus Transfers from the Government

As a component of the direct taxes, income tax on individuals is almost negligible. In most years, government data sources do not even report it. The unique characteristics of Saudi Arabia's tax system will be further discussed in the chapter on Government Revenue. The Personal Disposable Income here obtained should be understood as an approximation only. Table 4.2 explains the process by which this approximation is derived.

Alternative Theoretical Specifications of the Consumption Function

The simple Keynesian consumption function

The simple Keynesian consumption function (1936) is based on the psychological premise that an individual's consumption behavior is

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[12]This item includes: Income tax on oil companies, income tax on individuals, income tax on other companies, Zakah and Jehad.

[13]In the national accounts of Saudi Arabia, this item is negative, which means that transfer to the rest of the world is always greater.

Table 4.2. Data used in constructing aggregate private consumption function (million Saudi Riyals)[a]

Year	National income	Direct taxes				Total direct taxes (-)	Transfers to rest of world (-)	Transfers from government (+)	Disposable personal income (PY_t)	Total private consumption expenditure (PC_t)
		Income tax on oil companies	Income tax on other companies	Income tax on individuals	Zakah and Jehad					
1970	13574	3522	--	--	--	3522	900	600	9152	5859
1971	17242	3963	--	--	--	3963	903	597	12379	6412
1972	20589	7628	44	98	8	7778	962	666	12515	6915
1973	30095	9569	45	102	11	9726	1406	628	19590	7896
1974	82350	15774	70	144	13	16000	1987	902	65265	9828
1975	125398	56655	95	196	16	56962	2752	2048	67732	18039
1976	165394	65512	190	--	27	65729	3876	15390	111179	23903
1977	207723	76504	350	--	35	76889	5426	3838	129246	34372
1978	221967	98665	672	--	98	99434	7596	4744	119681	54607
1979	242901	88092	1400	--	120	89612	10035	2487	145741	68608
1980	381706	119003	--	--	175	119178	11492	3087	255225	83948
1981	508427	198706	--	--	115	198821	14835	14063	308834	102688
1982	522916	249116	--	--	200	249316	13757	14912	274755	126514

[a]This table was constructed from data available in: (1) National Accounts of Saudi Arabia, Central Department of Statistics, Ministry of Finance and National Economy, Riyadh, 1981; 1982; (2) Statistical Indicators, Central Department of Statistics, Ministry of Finance and National Economy, 1980; (3) SAMA Annual Report, Riyadh, Saudi Arabia, various issues; and (4) Statistical Summary, Saudi Arabian Monetary Agency, Research and Statistics Department, Jeddah, Saudi Arabia, various issues.

primarily determined by his disposable income. This was the first function of its kind in economic literature. It states:

$$C = f(Y_d) \tag{4.1}$$

where:

C is the private consumption expenditure;

Y_d is the disposable personal income; and

f is the function form which explains the relationship between the dependent variable (C) and the independent variable (Y_d).

Equation 4.1 may be rewritten in linear form as:

$$C = \beta_0 + \beta_1 Y_d \tag{4.2}$$

where:

$\beta_0 > 0$, and

$0 < \beta_1 < 1$.

As we see, β_1 is restricted to positive values less than unity. The economic interpretation of the β_1 parameter is known as the "marginal propensity to consume (MPC)." It is positive, meaning that higher disposable personal incomes (Y_d) produce higher consumption expenditures. Restricting it to values less than one means that for each dollar increase in disposable personal income, only a fraction (β_1) is spent on consumption.

The "average propensity to consume (APC)" is obtained by dividing equation 4.2 by disposable personal income:

$$\frac{C}{Y_d} = \frac{\beta_0}{Y_d} + \beta_1$$

or

$$APC = \frac{\beta_0}{Y_d} + \beta_1 \qquad (4.3)$$

As shown, one characteristic of the simple or short-run Keynsian consumption function is that APC > MPC. This becomes clear when we know that $\frac{\beta_0}{Y_d}$ is positive because it is restricted to values greater than zero ($\beta_0 > 0$). Characteristically, APC declines as Y_d increases. This can be seen by differentiating equation 4.3 with respect to Y_d to obtain $(-\beta_0 Y_d^{-2})$, which is negative. This can be explained graphically as:

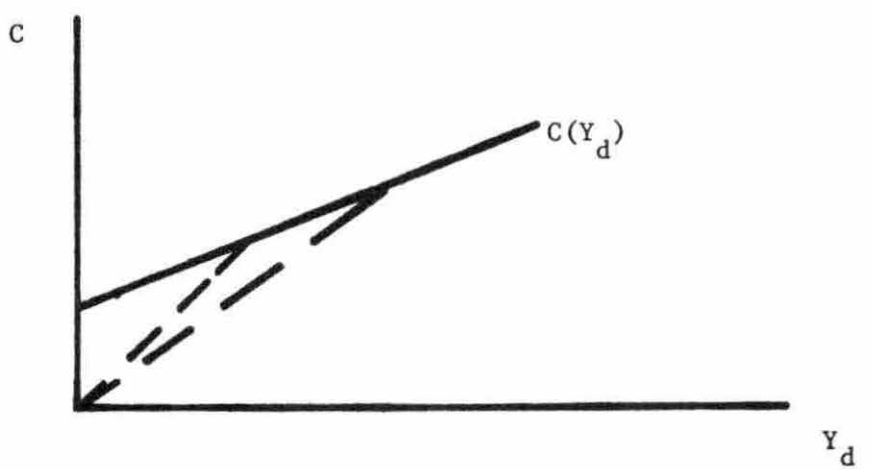

Figure 4.1. MPC and AVC generalized by the simple Keynesian consumption function

The slope of the solid line represents the slope of the consumption function (MPC). The slope of the dotted lines from the origin to a point on the consumption function represents the average propensity to consume $(\frac{C}{Y_d})$. The graph shows that MPC is lower than APC and that

APC $(\frac{C}{Y_d})$ falls as disposable income rises. In other words, the solid line is always flatter than any line connecting the original point with any point on the solid line.

Kuznet's study brought the first challenge to the simple Keynesian consumption function.[14] Kuznets rejects the hypothesized generalized by the simple Keynesian consumption function, which states that the APC declines as income level rises. Kuznets claims that in the long run, the APC has no tendency to change over time. He found the APC for three overlapping 30-year periods (1869-1898; 1884-1913; and 1904-1933) to be 0.867, 0.867, and 0.879, respectively. Therefore, he concluded, APC shows such a small variation that it may be considered constant over long periods and moreover, APC does not decline. This is a clear contradiction of equation 4.2's prediction that APC falls as income rises. If the long-run APC is constant, the long-run MPC equals it as income rises. This results in a long-run consumption function which passes through the origin.

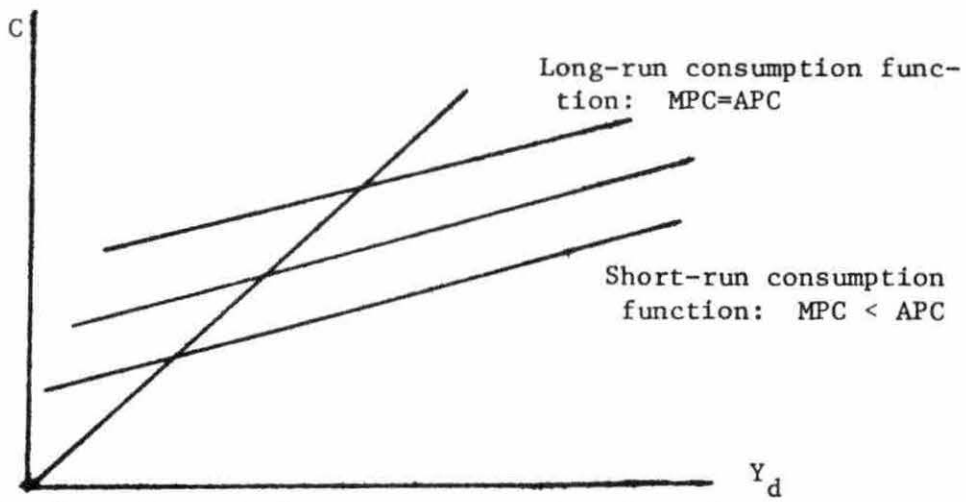

Figure 4.2. Long-run and short-run consumption function

[14]Simon Kuznets, National Product since 1869, and National Income, A Summary of Findings, National Bureau of Economic Research, New York, 1946.

The permanent income hypothesis (PIH)

The difference between long-run and short-run MPCs has resulted in several attempts to explain the deviation between the two. Significant statistical results show that equation 4.2 is not a reliable predictor of long-run consuming unit behavior. Therefore, alternative consumption hypotheses have been posed to explain the conflict between long-run and short-run MPCs. These hypotheses differ basically in the approach taken to solve the problem. Milton Friedman's "Permanent Income Hypothesis (PIH)" explains the conflict by assuming that the individual takes into account his permanent income, as well as his current income, when he determines his current consumption. This theory argues that people gear their consumption behavior to permanent or long-run consumption opportunities, and not to their current levels of consumption. Suppose, for illustration, that we have two individuals. One has a fairly steady income; the other does not. Their average income over a certain period is the same, but the monthly or yearly variation between the two is great. The permanent income component of the first is higher because his income is stable. The other behaves differently, and perhaps erratically, because he has very large transitory components which he did not (or could not) take into account to determine consumption behavior. This theory breaks the consumption function into two equations:

$$C_t = C^P + C^T \tag{4.4}$$

and

$$Y_t = Y^P + Y^T \tag{4.5}$$

where:

C_t is the observed consumption;

C^P is the permanent consumption;

C^T is the transitory consumption;

Y_t is the observed disposable income;

Y^P is the permanent income; and

Y^T is the transitory income.

It is generally assumed that permanent consumption equals actual consumption and that C^T is very small. (It is assumed to approach zero.) Harder to determine are Y^P and Y^T. Friedman's solution posited that consumption over time is a proportion of permanent income only. Therefore, Friedman assumes that transitory income cancels out over time and has no substantial affect on consumption. Given these assumptions, the consumption function becomes:

$$C_t = CY_t^P \tag{4.6}$$

This final form is based on the following procedures:

$$Y_t^P = \theta Y_t + (1 - \theta)Y_{t-1} \tag{4.7}$$

where:

$0 < \theta < 1$;

θ is a weight; and

Y_{t-1} is the last year's income.

Substituting equation 4.7 into 4.6 results in:

$$\begin{aligned} C_t &= C(\theta Y_t + (1 - \theta)Y_{t-1}) \\ &= C\theta Y_t + C(1-\theta)Y_{t-1} \end{aligned} \tag{4.8}$$

This states that consumption depends on both current income (Y_t) and the last year's income. However, in estimating this function, Friedman looked at in many earlier periods, as well as current income. There is no exact determination of θ in the successive years included in this consumption function. Therefore, the most it can do is assign diminishing values of θ as time passes backwards. This means, essentially, that recent income has more influence on permanent income than does earlier income. This argument can be illustrated graphically as:

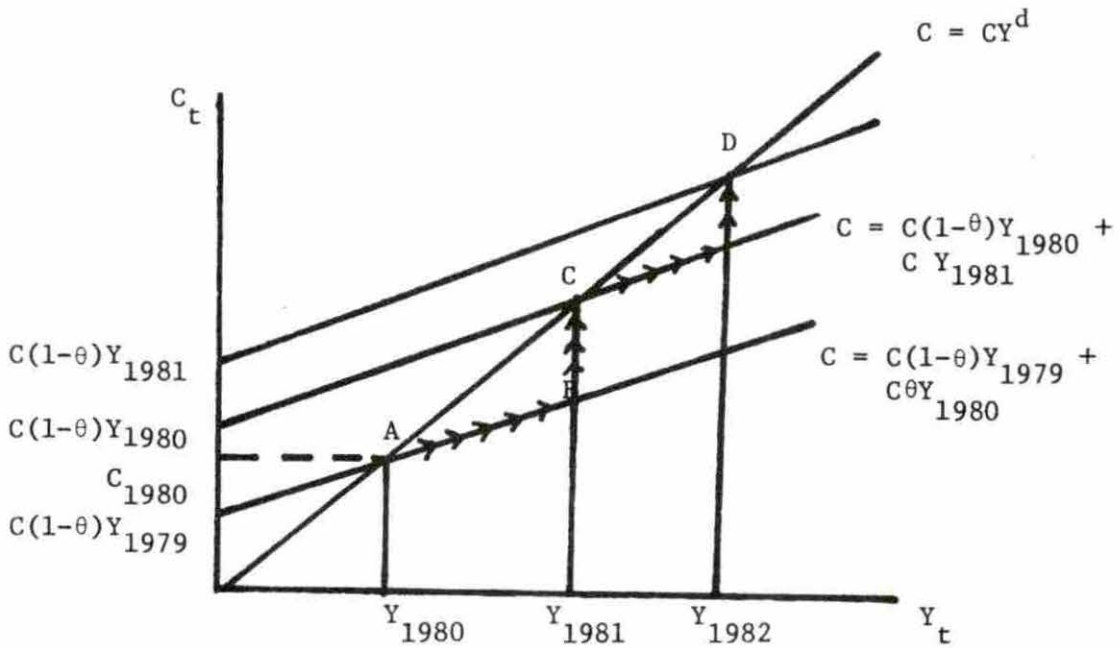

Figure 4.3. The permanent income hypothesis function

Suppose $C = C(1-\theta)Y_{1979} + C\theta Y_{1980}$. If the current value of $Y_{1980} = 0$, the 1980 level of consumption = $C(1-\theta)Y_{1979}$. The slope of this function is $C\theta$. If we consider only $C\theta Y_{1980}$, it becomes the short-run consumption

function for a particular time. However, if we consider $C(1-\theta)Y_{1979}$, it becomes the long-run consumption function. Assuming Y_{1980} in the above graph, current short-run consumption = C_{1980}. Assuming permanent and actual incomes are equal, this represents a long-run equilibrium point (A). If the individual's 1980 income increases to Y_{1981}, two things will happen: First, he will move to the right along his short-run consumption function to Point (B). But, when he moves to 1981, his last year's value of Y has increased and the curve has shifted, because $C(1-\theta)Y_{1980} > C(1-\theta)Y_{1979}$; therefore, the second point in the long-run consumption function becomes (C) instead of (B). If this happens repeatedly, the long-run consumption function will pass through the origin and be flatter than the short-run consumption function. The APC declines moving along the short-run function. However, as the individual's permanent income increases, the increased income of previous years persists and he adjusts his consumption according to his long-run income. Therefore, consumption increases as income increases, making APC constant.

The long-run consumption level adjustment

One may apply Nerlove's model of output adjustment (x) to long-run equilibrium output (x*) over time in response to changes in price levels[15] by substituting consumption for output and income for price. If the level of income is considered to increase, how will the consumption level adjust to it? Consumption may not adjust soon. It often

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[15]Marc Nerlove, The Dynamics of Supply: An Estimation of Farmers' Response to Price, Johns Hopkins Press, Baltimore, 1958.

takes time to create a situation in which actual consumption equals intended consumption. Consumers adjust gradually until the consumption level desired for a given income is reached. The following graph may explain the path of consumption:

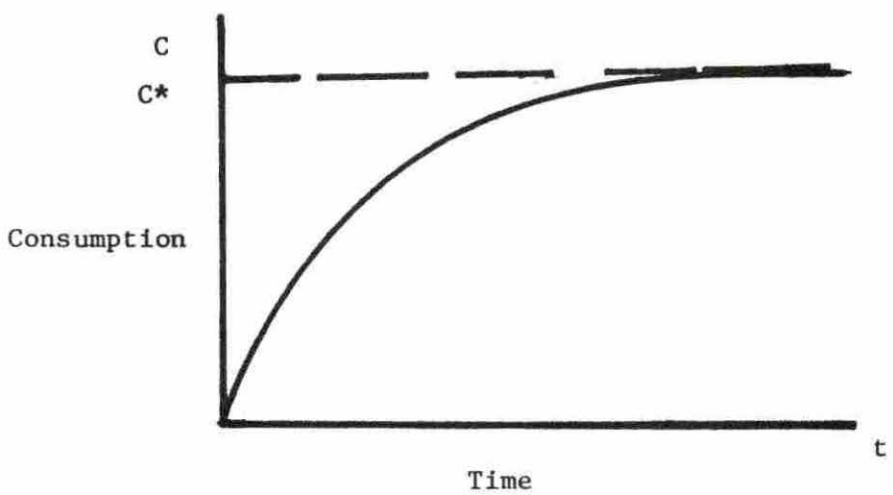

Figure 4.4. Adjustment of consumption (C) to long-run equilibrium consumption (C*) over time, in response to a change in the level of income

The rate of adjustment depends on the availability of means by which adjustment is made possible.

The graph shows that actual consumption, C, depends on both the level of long-run intended consumption (C*) and time. Since C* constantly changes over time, we cannot predict the levels of C as it approaches C*, even if t is known. This suggests forming a relationship between C and C* which holds for any point in time. One such plausible relationship is that each period's actual consumption adjusts proportionately to the difference between the desired long-run level of

consumption and actual consumption. Therefore, the relationship is:

$$C_t - C_{t-1} = \gamma(C_t^* - C_{t-1}) \tag{4.9}$$

where:

$0 < \gamma \leq 1$.

We assume that γ is a constant whose value depends on the consumer's elasticity of adjustment as a response to changes in income. Therefore, γ is the coefficient of adjustment.

To find a relationship connecting levels of actual consumption at different times with observed levels of income at other different times, one must assume a relationship between expected levels of future income (Y*) and desired levels of long-run consumption (C*). It can be assumed that:

$$C_t^* = aY_t^* \tag{4.10}$$

Solving equation 4.10 for Y_t^* produces:

$$Y_t^* = \frac{C_t^*}{a} \tag{4.10'}$$

If Y_t^* is the consumer's expectations of long-run income at time t, and if Y_t is the consumer's actual income, Y_t^* can be made to equal the last period's expectation of long-run income (Y_{t-1}^*) by using an adjustment factor proportioned to the difference between actual and expected long-run income ($Y_{t-1} - Y_{t-1}^*$). Mathematically,

$$Y_t^* = Y_{t-1}^* + \beta(Y_{t-1} - Y_{t-1}^*) \tag{4.11}$$

meaning that, in each period, consumers revise their notion of long-run

income proportionate to the difference between current income and previously expected long-run income. However, equation 4.11 can be rewritten as:

$$Y_t^* = \beta Y_{t-1} + (1 - \beta)Y^*_{t-1} \tag{4.12}$$

This new form can be called a weighted moving average of past actual income, in which the weights decline as we go back in time.

Substituting equation 4.10' into 4.12 yields:

$$Y_t^* = \beta Y_{t-1} + (1 - \beta) \frac{C^*_{t-1}}{a} \tag{4.13}$$

Substitution equation 4.13 into 4.10 yields

$$C_t^* = a\beta Y_{t-1} + (1 - \beta)C^*_{t-1} \tag{4.14}$$

Therefore, one may conclude that current long-run consumption is determined by both income level and consumption in lagged form.

Specification and Estimation of Equations

All theoretical specifications of the private consumption function previously discussed are here applied. These specifications are:

$$PC_t = \alpha_0 + \alpha_1 PY_t + e_t \tag{4.15}$$

$$PC_t = \alpha_0 + \alpha_1 PY_{t-1} + e_t \tag{4.16}$$

$$PC_t = \alpha_0 + \alpha_1 PY_t + \alpha_2 PY_{t-1} + e_t \tag{4.17}$$

$$PC_t = \alpha_0 + \alpha_1 PC_{t-1} + \alpha_2 PY_{t-1} + e_t \tag{4.18}$$

Regression results of the above specification are summarized in Table 4.3. The simple Keynesian consumption function was first applied. The

Table 4.3. Statistical results: dependent variable in private consumption (PC)

Equation	Intercept	PY_t	PY_{t-1}	PC_{t-1}	$\bar{R}^2$	F	DW	W/Prob<W
4.15	-2191 (-0.4)[a]	0.37 (10.35)			0.89	107	1.59	0.92/0.37
4.16	1853 (0.45)		0.41 (13.63)		0.93	185	1.25	0.86/0.05
4.17	-769 (-0.19)	0.14 (1.83)	0.28 (3.51)		0.94	114	1.30	0.92/0.39
4.18	1450 (1.06)		0.09 (2.36)	0.98 (9.41)	0.99	876	1.24	0.83/0.002
4.19	2005 (1.25)		(35.16)	1.22	0.99	1236	1.32	0.74/0.01

[a]Values in parentheses are t-ratios.

coefficient of PY_t has the expected sign a priori, the t-ratio is very high (10.35), and the adjusted R-squared is acceptable. However, the specification was rejected because the Saudi Arabian economy has limited absorptive capacity. Saudi Arabia lacks advanced market facilities, storage, refrigerators, advanced transportation networks connecting the different parts of the kingdom, etc. Therefore, a complete consumption adjustment in response to changes in income will not occur in the same year. This delays the peoples' ability to fulfill their material desires until such facilities have been at least partially provided.

Equation 4.16 shows an improved consumption function employing an adjusted R-squared ($\bar{R}^2$) and t-ratio; even the magnitude of the

coefficient shows promise of including the lagged forms of Y_t as regressors in the private consumption function. However, in spite of all good statistical results, this equation was also rejected in hopes of finding a meaningful marginal propensity to consume, which is still very low in this specification.

The permanent income hypothesis (4.17) passes almost all the conventional statistical tests. However, the form does not fit the criteria of the private consumption sector of the Saudi economy. As previously discussed, one year is not enough to have a full adjustment in the private consumption. The short-run and long-run marginal propensities to consume (MPC_S, MPC_L) are both low, providing another reason to reject this hypothesis. In equation 4.18, the long-run consumption level hypothesis was used, in which $\bar{R}^2$ approaches unity and t ratios are especially high for the variable C_{t-1}. This specification seems best overall. However, it was also rejected, even though we believe it fits the characteristics of the Saudi economy, because the poor data base yields a MPC_L of 4. Such a MPC_L is meaningless and nonsensical![16] The same is true of very small MPC_S, i.e., 0.09.

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[16] The MPC_L, or the dynamic MPC, is defined according to equation 4.18 as:

$$MPC_L = \left(\frac{\partial C_t}{\partial Y_t}\right) \cdot 1 - \left(\frac{\partial C_t}{\partial C_{t-1}}\right)^{-1}$$

The MPC_S is: $\frac{\partial C_t}{\partial Y_t}$.

Equation 4.5 shows a dramatic growth rate in private consumption, of 0.22, which highly exceeds the rate of growth in most LDCs.

Although the above specifications each have good statistical results, they fail to reflect a reasonable magnitude of the long-run and short-run marginal propensities to consume, given the characteristics of the Saudi economy. However, a period of four years would suffice to have a full adjustment in the consumptions. Therefore, the income of Y_{t-4} has no significant influence on current private consumption. Based on the above assumptions, we may apply the following form:

$$PC_t = \alpha_1 PY_t + \alpha_2 PY_{t-1} + \alpha_3 PY_{t-2} + \alpha_4 PY_{t-3} + e_t \qquad (4.19)$$

The following is the result of fitting equation 4.19:

$$\underset{}{C_t} = \underset{(-0.92)}{-0.13\ PY_t} \underset{(-0.08)}{-\ 0.01\ PY_{t-1}} + \underset{(1.67)}{0.21\ PY_{t-2}} + \underset{(1.94)}{0.41\ PY_{t-3}}$$

$$\bar{R}^2 = 0.96,\ DW = 1.46,\ F = 71 \quad .$$

This specification was also rejected for the simple reason that the coefficients of PY_t and PY_{t-1} are wrong. The influence of the income for year t-i (where i = 0, 1, 2, 3) should not be treated equally in terms of its influence on current consumption. More recent income has the strongest influence on current consumption. Therefore, different weights have been assigned to each coefficient. In restricted form, the above equation can be rewritten:

$$PC_t = \alpha_1 PY_t + \lambda\alpha_1 PY_{t-1} + \lambda^2\alpha_1 PY_{t-2} + \lambda^3\alpha_1 PY_{t-3} + e_t \qquad (4.19')$$

where:

$$\alpha_1 = \lambda^0 \alpha_1$$

$$\alpha_2 = \lambda \alpha_1$$

$$\alpha_3 = \lambda^2 \alpha_1$$

$$\alpha_4 = \lambda^3 \alpha_1$$

λ is the rate of adjustment, assumed to be 0.30, which is determined empirically as the best. If the right-hand side can be rewritten as:

$$\alpha_1 (Y_t + \lambda Y_{t-1} + \lambda^2 Y_{t-2} + \lambda^3 Y_{t-3})$$

we end up with estimating only one coefficient, α_1. If the bracketed section is denoted by U1*, then

$$C_t = \alpha_1 U1 \tag{4.20}$$

---

*Let us define:

$$Y_t + \lambda Y_{t-1} + \lambda^2 Y_{t-1} + \lambda^2 Y_{t-2} + \lambda^3 Y_{t-3} = U$$

and:

$$1 + \lambda + \lambda^2 + \lambda^3 = \lambda^0$$

To have the total weights sum up to unity:

$$\frac{1}{\lambda^0} Y_t + \frac{\lambda}{\lambda^0} Y_{t-1} + \frac{\lambda^2}{\lambda^0} Y_{t-2} + \frac{\lambda^3}{\lambda^0} Y_{t-3} \quad .$$

Hence:

$$C_t = \alpha_1 \frac{U}{\lambda^0} \text{ , where } \frac{U}{\lambda} = U1 \quad .$$

The estimation of equation 4.20 is:

$$C_t = 0.40\ U1 \tag{4.21}$$

The estimation of equation 4.19', therefore, is:

$$C_t = 0.40Y_t + 0.12Y_{t-1} + 0.04Y_{t-2} + 0.0031Y_{t-3}$$

The MPC_L, in this estimated function, is 0.56; this is the sum of the coefficients of the four independent variables. The $MPC_S = 0.40$. This form is considered the best we can get, given the available data.

Specification 4.19 was also used in log form, and the result is:

$$\text{Log } PC_t = 0.88 \text{ log } PY_t + 0.26 \text{ log } PY_{t-1} + 0.07 \text{ log } PY_{t-2} + 0.007 \text{ log } PY_{t-3} \tag{4.22}$$

The sum of the coefficients is 1.21, which is too high and leads to reject it.

Both MPC_L and MPC_S in specification 4.19 are still lower than what was expected a priori. Possible justifications are: The high percentage of foreign laborers in the country, whose main purpose is to save as much as possible of their income, offers a possible justification of MPC_L and MPC_S underestimates. Again, the LDC problem of data arises and handicaps analysis. This difference biases the overall MPC downward. Also, another possible justification is that the government heavily subsidizes most of the basic food items, as well as medical services, pharmaceuticals, and education, which may also explain the low MPC. However, the poor data base and small sample size used may

explain this contradiction. The high MPC belief is justified by Al-Bashir as:[17]

> 1. The country's dependency on imports in meeting its demands, coupled with its liberal import policy, introduces new goods and services almost annually. The awareness of the existence and availability of such new items in the local market means that the demonstration effect is an important inducement to spend more.
>
> 2. The country's wealth is characterized by its recent and sudden nature. An illiterate individual who suddenly finds himself wealthy is more inclined to spend most of his income on consumption than an educated person, who may be more aware of the importance of saving for investment purposes. This is a short-run phenomenon, because even an illiterate may learn with time the value of savings. Based on this short-sightedness and the high percentage of illiteracy, the likelihood of finding a high marginal propensity to consume is very probable.
>
> 3. Satisfaction of consumption needs, if it is ever achieved, takes time to materialize. Therefore, starting from a primitive base of recent wealth and limited goods and services in a consumer's basket, it is to be expected that the country and its people will at first indulge in high and rising consumption, while later more rational behavior may prevail and part of the resources may be diverted from a conspicuous type of consumption to investments.

James Duesenberry's relative income hypothesis argues that current consumption expenditure depends not only on current income, but also on the consumption level generated by the income peak in the past. Individuals respond differently if income increases than if it decreases. Once accustomed to a high standard of living, it is difficult for an individual to lower it when his income decreases. This suggests that the consumption function may take the form:

$$C_t = C(Y_t, Y_{peak}) \tag{4.23}$$

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[17] Al-Bashir, pp. 54-55.

Saudi Arabia's high rate of growth in oil revenues implies that Y_t is growing almost every year. Therefore:

$$Y = ae^{\alpha t} \tag{4.24}$$

where:

Y = income

T = time

or

$$\log Y = \log a + \alpha \log t \tag{4.25}$$

A logarithmic plot results in almost a straight line (Figure 4.5), meaning that every year's income should be considered as a peak, relative to the previous year's income. Therefore, we have only one independent variable according to Duesenberry's hypothesis, Y_t. Hence, the relative income hypothesis is not applicable to our case.

The Government Consumption Expenditure

Government consumption expenditures constitute a high percentage of the country's total consumption expenditure. Table 4.4 shows the total government expenditure and its percentage of total consumption. As we can observe, the government consumption expenditure is close to 50 percent of average total consumption (0.46). It consists of expenditures for various goods and services. Examples are providing free health services, free education, armed forces, and other social and administrative services.

In terms of behavioral determinants, this part of consumption should not be treated equally with private consumption expenditures.

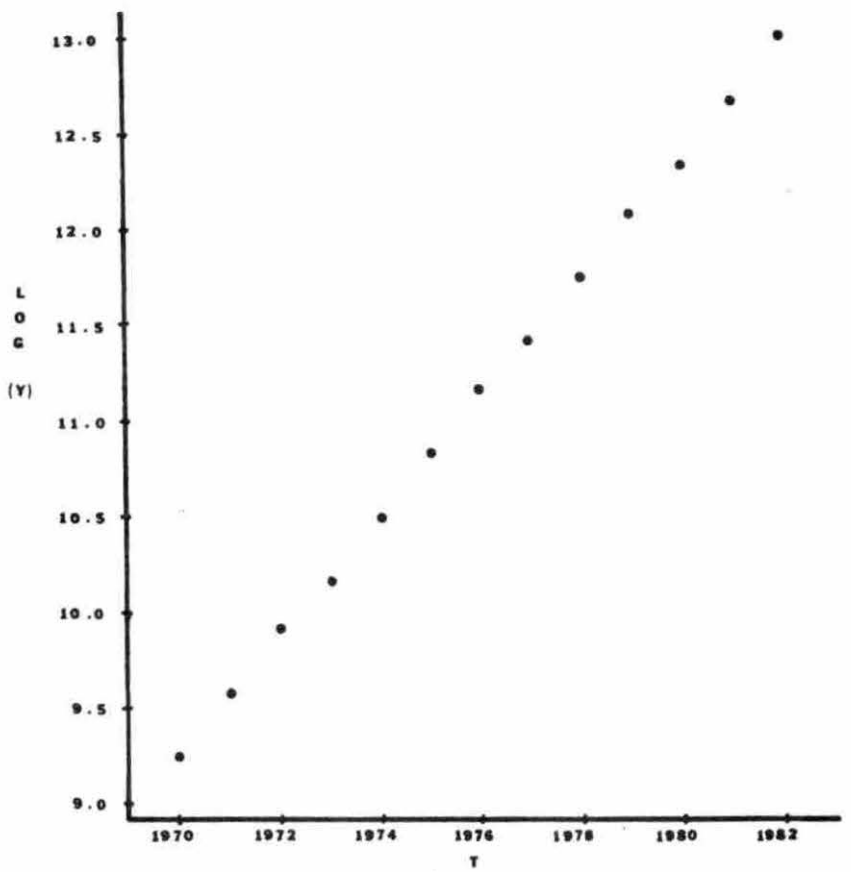

Figure 4.5. Plotting of the relative income hypothesis

Table 4.4. Government consumption relative to total consumption (million Saudi riyals)[a]

Year	Private consumption	Government consumption	Total consumption	Government consumption as percentage of total consumption
1970	5859	3421	9280	0.37
1971	6412	3798	10210	0.37
1972	6914	4285	11199	0.38
1973	7895	5335	13230	0.40
1974	9827	9864	19691	0.50
1975	18039	15911	33950	0.47
1976	23903	28883	52786	0.50
1977	34372	41033	75405	0.54
1978	54607	47034	101641	0.46
1979	68608	71904	140512	0.51
1980	83948	88206	172154	0.52
1981	102688	83744	186532	0.45

[a]Sources: SAMA Annual Reports, various issues; Statistical Summary, 1982.

In fact, almost every year government revenues exceed the capacity for expenditure. Therefore, there is no direct causal relationship between the government's revenues and its consumption expenditure. If the government budget always had a surplus, at least during most of the period early in the '70s and at the beginning of the '80s, it is meaningless to say that increasing government revenues or even having a budget surplus during the period increases government consumption (Table 4.5). Government consumption expenditures are determined by other factors than government revenues. The economy's absorptive capacity or the inflation rate might lead to use of government revenues as a policy tool to reduce inflation. However, this might not be a significant factor; one of the main criticisms of national development

Table 4.5. Actual government budget surplus (million Saudi riyals)[a]

Year	Actual government revenues	Actual government expenditures	Budget surplus
1970	5668	6079	-411
1971	7954	6294	+1660
1972	11116	8130	+2986
1973	15325	10159	+5166
1974	41705	18595	+23110
1975	100103	32038	+68065
1976	103384	81784	+21600
1977	135957	128273	+21600
1978	130659	138048	+7684
1979	132871	147400	-14529
1980	211196	188363	+22833
1981	348100	236570	+111530
1982	366500	288200	+78300

[a]Sources: SAMA Annual Reports, issues 1972/73, 1976, 1979; Statistical Summary issue, 1982.

plans, especially of the second development plan (1975-1980), is that its attempt to transform Saudi Arabia into an industrial nation in a short period of time was overly ambitious.[18] It seems that when a target level of growth rate is set, the economy should achieve that target. Accepting the high inflation rate as a price paid for achieving it.

[18]Martan, p. 88.

CHAPTER 5. INVESTMENT FUNCTION

Investment in Saudi Arabia during the First and Second Development Plans (1970-1980) concentrated on building a strong infrastructure as a base for industrialization and development in other sectors. Such investments were government conducted because of their relatively large size, and also because the private sector was not capable of handling them. Investment in Saudi Arabia is characterized by two features:[1]

(1) At least 50 percent of the annual gross fixed investment since 1960 originated in the government budget. Almost all government investment has been in social overhead projects, such as roads, hospitals and schools.

(2) Most investment in the country (private as well as public) goes into construction activities (houses, roads, etc.). The only exception is an insignificant amount of the total, which was invested in the small manufacturing sector.

Tables 5.1 and 5.2 show the distribution of the gross fixed capital formation between the public and private sectors and the allocation of gross investment among the different types of investment. Table 5.1 shows the government's participatory role in investment. During the period 1970-1980, government investments averaged almost 50 percent of the country's total investments. Government participation during the period of 1975-1980 was almost 60 percent. Table 5.2 shows the pattern

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[1] Al-Bashir, A Structural Econometric Model of the Saudi Arabian Economy, p. 75.

Table 5.1. Government investment and its share of the total gross fixed formation (million Saudi riyals)[a]

Year	Government investment	Private investment	Government investment as a percentage of the total investment
1970	1214	1383	0.47
1971	1204	1727	0.40
1972	1443	1960	0.42
1973	1985	3709	0.35
1974	3416	4984	0.41
1975	7370	10329	0.42
1976	17491	16049	0.52
1977	27352	23839	0.53
1978	40484	26407	0.61
1979	49031	27623	0.64
1980	61598	33379	0.65

[a]Source: SAMA Annual Report, issues 1981, 1980, 1977.

Table 5.2. Gross fixed capital formation by type of investment[a] (million Saudi riyals)

Year	Construction	Transport equipment	Machinery	Other capital goods	Total investment
1970	1969 (76)[b]	309 (12)	319 (12)	--	2597 (100)
1971	2196 (75)	313 (11)	423 (14)	--	2932 (100)
1972	2595 (76)	335 (10)	473 (14)	--	3403 (100)
1973	4706 (83)	468 (8)	520 (9)	--	5694 (100)
1974	6214 (74)	757 (9)	1429 (17)	--	8400 (100)
1975	13222 (75)	2253 (13)	2021 (11)	203 (1)	17699 (100)
1976	26888 (80)	3539 (11)	2798 (8)	315 (1)	33540 (100)
1977	37684 (74)	5491 (12)	7546 (11)	470 (1)	51191 (100)
1978	51542 (77)	6391 (10)	7778 (11)	1180 (2)	66891 (100)
1979	63412 (83)	6756 (9)	5926 (7)	560 (1)	76654 (100)
1980	76864 (81)	6911 (7)	10685 (11)	517 (1)	94977 (100)

[a]Source: SAMA Annual Report, Issues 1981, 1980, 1977.

[b]The values in parentheses are the percentage of each component to the total investment.

of domestic investment. About 80 percent of the gross fixed capital was invested in construction projects; 10 percent was spent on transport equipment; the remaining 11 percent was invested in machinery. One of the Saudi Arabian planners' main objectives was the building of a strong physical infrastructure to create an environment in which industrialization can take place.[2]

> Because of the abundance of oil revenues and the confidence they generate in the minds of decision-makers, no social preference rate (i.e., discount rate) has ever been applied to determine whether a public project should be adopted. We are dealing here with government investment decisions which derive their justification from the country's physical need for highways, schools, and hospitals. Given the wealth of the government, these projects will be implemented (political reasons aside), whether they are profitable or not.[3]

The above analysis illustrates that interest rates, profits, and most other theoretical determinants are not major factors in determining investment in Saudi Arabia, at least not from the government's point of view.

A small portion of private investments were made in the manufacturing sector. Table 5.2 shows the relatively small portion of the total investment used for manufacturing. Until the beginning of the 1980s, the high inflation rate caused people to avoid investment in factories because such investment requires a relatively long payback period. Instead, private investors chose investments having very short payback

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[2]Second Development Plan (1975-1980), Ministry of Planning, Riyadh, April 27, 1975, p. 4.

[3]Al-Bashir, A Structural Econometric Model of the Saudi Arabian Economy, p. 75.

periods with very high rates of return. Investment in real estate has been very profitable since foreigners are not allowed to own houses. There are many foreigners in the country, leading to higher housing prices. Hence, more investments go to real estate than anything else. To stimulate private investment, the government undertook direct and indirect incentives. Indirect incentives are provided by creating an environment in which the means for success become available. Direct incentives were provided through government lending agencies, such as the Saudi Industrial Development Fund (SIDF), the Real Estate Development Fund (REDF), and the Saudi Agricultural Bank, which provided financial supports, and through such other agencies as the Industrial Studies and Development Center, which provided appraisal studies for private projects. When necessary, the government sometimes participated as a production partner in large scale projects. All imported machinery is exempted from import duties.

A survey conducted by the Industrial Studies and Development Center (1969) showed that almost all factories were managed and financed by the owner (usually a family); 80 percent of the invested capital in all factories surveyed belonged to the owner (i.e., no borrowing). On this basis, one may discount interest rates as determining factors in investment decisions.[4] However, this does not mean that Saudi Arabia has no interest rates, even though all Islamic laws are against them. The commercial banks in the country all charge interest when providing loans.

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[4]Al-Bashir, pp. 75-76.

The SIDF, with its medium-term, low-interest loans, had, by early 1980, committed SR 5.5 billion, with SR 3.5 billion actually being disbursed, over its first five years of operation.[5] An interest rate of about 2.5 percent is said to be charged for such loans. However, it is not clear if the interest rate has a significant influence in determining the domestic private investment. No data are available to explain the portion and direction of private investment outside the country. If such investments hold a significant portion of the private investment capital, one would expect interest rates in each outside region, among other things, to be considered as determinants of investment.

Specification and Estimation of Equations

As previously discussed, one may assume that interest rates and most other traditional factors will not be considered here. Due to the limited absorptive capacity of the economy, partial adjustment between the dependent and independent variables is applied. Also, the limitation of availability of private sector data restricts our analysis of the investment pattern in the country as a whole. Therefore, there will be no distinction between private and public investment. A more disaggregated investment function (public vs. private) may yield a more satisfactory explanation of Saudi investment behavior. However, due to the important role of the government in total investment, and due to the apparent strong relationship between private and public investment,

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[5]Robert E. Looney, Saudi Arabia's Development Potential, Lexington Books, D. C. Heath and Company, Lexington, Mass., 1982.

only those variables which influence investment as a whole and government investment are here considered. We hope this will yield a reasonable explanation of the country's investment behavior.

Data

The following are definitions of the variables used in estimating the total investment function:

I_t = Total Investment

E_t = Total Oil Exports

GR_t = Total Government Revenues

Y_t = Gross Domestic Product

P_t = Oil Prices

TB_t = Tax per Barrel

The variables were deflated by the appropriate deflator in order to present real values. Since almost all of the materials used in investment are imported from abroad, the total investment data were deflated with the import unit value index. All other variables were deflated with the GDP deflator. The subscripts (t, t-1) mean the variable in the current year and lagged on year, respectively. Table 5.3 presents the observations used to estimate the total investment function.

Statistical Results

Four types of investment functions have been applied in trying to find the appropriate one that can fit well the characteristics of the Saudi economy. These types are as follows:

Table 5.3. Data used in estimating the total investment function (at current prices)[a]

	Million Saudi Riyals				Riyals	
Year	I_t	Y_t	E_t	GR_t	P_t	TB_t
1969	2632	15975	9086	--	8.10	2.61
1970	2597	17399	10302	5966	8.10	2.57
1971	2931	22921	15189	6380	8.10	2.28
1972	3403	28258	19862	10782	10.28	3.46
1973	3694	40551	30012	13200	10.38	3.45
1974	8400	99315	85682	22810	13.65	5.10
1975	17841	139600	114461	98247	42.60	21.94
1976	33540	164526	120284	95847	40.13	20.87
1977	51191	205056	140321	110935	40.24	22.78
1978	66891	225401	140762	146493	44.00	32.47
1979	76654	249539	147236	130000	42.71	25.32
1980	97068	385807	258488	160000	63.84	32.84

[a]Sources: Statistical Summary, various issues; SAMA Annual Report, various issues; National Accounts of Saudi Arabia, issues 1981 and 1982.

$$I_t = \alpha_0 + \alpha_1 GR_t + e_t \quad (5.1.a)$$

$$I_t = \alpha_0 + \alpha_1 E_t + e_t \quad (5.1.b)$$

$$I_t = \alpha_0 + \alpha_1 Y_t + e_t \quad (5.1.c)$$

$$I_t = \beta_0 + \beta_1 GR_{t-1} + \beta_2 I_{t-1} + et \quad (5.2.a)$$

$$I_t = \beta_0 + \beta_1 E_{t-1} + \beta_2 I_{t-1} + e_t \quad (5.2.b)$$

$$I_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 I_{t-1} + e_t \quad (5.2.c)$$

$$\log I_t = \beta_0 + \beta_1 \log Y_{t-1} + \beta_2 \log I_{t-1} + e_t \quad (5.3.a)$$

$$\log I_t = \beta_0 + \beta_1 \log E_{t-1} + \beta_2 \log I_{t-1} + e_t \quad (5.3.b)$$

$$\log I_t = \beta_0 + \beta_1 \log GR_{t-1} + \beta_2 \log I_{t-1} + e_t \quad (5.3.c)$$

$$I_t = \gamma_0 + \gamma_1 P_{t-1} + \gamma_2 I_{t-1} + e_t \quad (5.4.a)$$

$$I_t = \gamma_0 + \gamma_1 TB_{t-1} + \gamma_2 I_{t-1} + e_t \quad (5.4.b)$$

The statistical results of the above equations are summarized in Table 5.4. The analysis was started by the very simple form of the investment function. In fact, all equations in the first group in Table 5.4 are characterized by the fact that they are in a very simple form. Due to the important role of the government in participation in the investment sector, we use the current government revenue as an independent variable in equation 5.1.a. Oil exports are the main generator of revenues to the country, and that is why we fit equation 5.1.b. And finally, we use the gross domestic product as a regressor in equation 5.1.c. All of equations 5.1.a-5.1.c are statistically acceptable. T-ratios are high, and $\bar{R}^2$ are acceptable. In the process of seeking more explanations for the behavior of investment given the

Table 5.4. Regression results: Investment is the dependent variable (I_t)

Equation	Intercept	Y_t	E_t	GR_t	$\bar{R}^2$	F	DW
5.1.a	-10470 (-2.29)[a]			0.52 (8.73)	0.86	76	1.73
5.1.b	-19657 (-1.92)		0.48 (4.58)		0.62	21	6.74
5.1.c	-30187 (-4.29)	0.40 (8.17)			0.84	66	0.55

Equation	Intercept	I_{t-1}	Y_{t-1}	E_{t-1}	GR_{t-1}	$\bar{R}^2$	F	DW
5.2.a	-2421 (-0.75)	0.71 (4.16)			0.22 (2.25)	0.95	121	2.07
5.2.b	-7484 (-2.17)	0.84 (9.97)		0.18 (3.51)		0.97	186	2.05
5.2.c	-11402 (-1.72)	0.73 (4.54)	0.17 (2.32)			0.96	124	1.11

Equation	Intercept	$\log I_{t-1}$	$\log Y_{t-1}$	$\log E_{t-1}$	$\log GR_{y-1}$	$\bar{R}^2$	F	DW
5.3.a	-1.88 (-0.85)	0.79 (3.39)			0.37 (0.96)	0.94	90	1.2
5.3.b	-5.83 (-2.96)	0.73 (7.23)		0.75 (3.14)		0.96	176	2.14
5.3.c	-9.19 (-2.67)	0.66 (4.77)	1.07 (2.75)			0.96	154	1.01

Equation	Intercept	I_{t-1}	P_{t-1}	TB_{t-1}	$\bar{R}^2$	F	DW
5.4.a	-3086 (-0.7)	1.04 (14.08)	1.65 (0.84)		0.95	116	0.89
5.4.b	-232 (-0.04)	0.98 (7.6)		35.4 (0.72)	0.94	114	1.14

[a]The values in parentheses are the T-ratios.

characteristic of the Saudi economy, we assume that a change in any of the variables in equations 5.1.a-5.1.c (GR_t, E_t, Y_t) will not yield a full adjustment in the domestic investment at the same period. Partial adjustment should be considered in determining the influence of these variables due to the limitation of the absorptive capacity of the economy and to the high rate of growth in these variables. That is why we turn to the second group where we repeat using the same variables but considering the fact that it takes time until we have the means by which the full adjustment is made possible. The coefficients of equations 5.2.a-5.2.c are all significant by any conventional statistical test. T-ratios in all of them are significantly different from zero. $\bar{R}^2$ in all equations are very high. From economic as well as statistical point of view, we are indifferent between selecting any of the equations in the second group. This might be a result of the high correlation among the three variables involved. Oil exports generate more than 90 percent of the total government revenue, and they represent a dominant component of the gross domestic product of the country.

The same specifications of the second group were also used again in log forms. The only problem in specification 5.3.a is the low t-ratio for the variable GR_{t-1}. The other equations have the problem of overestimating the coefficient of its variables.

Investment as a function of the rate of return has also been applied in the last group of Table 5.4. The coefficients of equation 5.4.a are very high, not to mention the low t-ratio for the coefficient of P_{t-1}. The price used in this equation (P_{t-1}) is the posted price of

oil which is not the realized price to the Saudi government. Part of it goes to the oil companies. Equation 5.4.b is also rejected because TB_{t-1} is not significantly different from zero (low t-ratio).

The Shapiro-Welk test statistic for the equations of the second group are 0.94, 0.93, 0.94, respectively. This makes us reasonably assume the normality of the dependent variable (I_t).

CHAPTER 6. THE GOVERNMENT REVENUE FUNCTION

The discovery of huge quantities of oil in Saudi Arabia played an important role in forming the structure of government revenue sources. Government oil revenues constitute almost all government revenues. This will be explained in more detail in Table 6.1. Oil is the main source of the government's revenue for the following reasons:

(1) Large scale oil extraction and export;

(2) The dramatic increase in world oil prices since 1973; and

(3) The backwardness of the nonoil sector of the country.

However, government policy with respect to production and pricing of crude oil stems from economic considerations as well as from political objectives. One Saudi economist writes:

> The policy of high supply and relatively low prices stems from political as well as economic factors. The government of Saudi Arabia has a vested interest in preserving the stability of the world economy in order to protect its own financial assets. It is also trying to assure its own political stability and that of its neighbors.[1]

This led not only to satisfying the government's needs to finance its ambitious development plans, but also to exceeding the expenditure absorptive capacity of the economy. The same economist also wrote:

> As a result of the abnormally low prices, Saudi Arabia in the 1960s and early 1970s had to stretch its small revenues from oil to cover its most essential projects. But in late 1974, the situation reversed itself and the problem became

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[1] Said Martan, "Domestic Development and the Management of Oil Revenues in the Economy of Saudi Arabia," Ph.D. Dissertation, University of Nebraska, Lincoln, Nebraska, 1980, p. 3.

Table 6.1. The structure of the government revenue and the percentage share of each component (million Saudi Riyals)[a]

Year	Oil royalty	Income tax on oil companies	Income from property and entrepreneurship	Indirect taxes[b]	Income tax on nonoil companies	Income tax on individuals	Zakah and Jehad	Miscellaneous income[c]	Total government revenue
1972	2231.3	7628.2	272.4	409.5	44.0	98.0	8.0	90.7	10782
1973	2537.2	9568.8	429.7	413.0	45.0	101.5	11.0	93.7	13200
1974	5336.5	15733.8	924.1	432.7	70.0	144.0	12.8	116.1	22810
1975	37561.0	56655.0	3045.0	534.7	95.0	196.0	16.0	144.3	98247
1976	21457.7	65511.9	8075.0	383.7	190.0	--	27.0	201.7	95847
1977	23002.0	76504.0	10258.0	512.2	350.0	--	34.5	275.3	110935
1978	31817.0	98665.0	13897.0	1016.4	671.5	--	97.5	328.6	146493
1979	24042.0	88092.0	11291.7	1410.6	1400.0	--	120.0	643.7	130000
1980	50991.5	161634.5	--	1516.3	--	--	175.0	--	216220
1981	58298.0	198706.0	--	2041.9	--	--	115.0	--	261516
1982	84848.0	249116.0	--	2546.9	--	--	200.0	--	340000
1972	21	71	3	4	0.4	1	0.1	1	100
1973	19	72	3	3	0.3	1	0.1	1	100
1974	23	69	4	2	0.3	1	0.1	1	100
1975	38	58	3	1	0.1	0.2	0.02	0.1	100
1976	22	68	8	0.4	0.2	--	0.02	0.2	100
1977	21	69	9	0.5	0.3	--	0.02	0.2	100
1978	22	67	9	0.7	0.5	--	0.07	0.2	100
1979	21	68	9	1	1	--	0.1	0.5	100
1980	24	75	--	0.7	--	--	0.1	--	100
1981	22	76	--	0.8	--	--	0.1	--	100

[a]Sources: National Accounts of Saudi Arabia, Central Department of Statistics, Ministry of Finance and National Economy, 1981, 1982 issues, pp. 41 and 73, respectively.

[b]Indirect tax includes taxes on petroleum products, custom duties, and vehicle licenses.

[c]Includes stamp duties and penalties, sales of surplus government property.

one of what to do with a vastly enlarged stream of income which flowed into the country.[2]

From Table 6.1, we can observe the following: By taking a general look at the various components of government revenues, one can see how the oil sector dominates the other sectors in terms of generating a tremendous amount of revenue for the budget of the Saudi Arabian government. The share of the oil sector (royalties, income tax on oil corporations, and participation earnings) on the average amounts to 93 percent of the government's revenues. Not only this, but in the early 1980s, it was 99 percent, 99 percent and 98 percent for 1980, 1981, and 1982, respectively.

The income tax on individuals in most countries plays an important role in financing their government expenditure. However, this is not the case in Saudi Arabia. The share of this component is almost negligible. Customs duties also have a very low share. It is reported in the table as part of the indirect taxes. In general, the bulk of government income from the nonoil sector consists of customs duties, public service fees, other indirect taxes, and taxes levied on individuals. There are four kinds of income tax in Saudi Arabia.[3]

(1) Zakat is levied on the total income minus fixed assets of Saudi Arabian nationals and firms at the uniform rate of 2.5 percent per annum. However, this is considered as a unique characteristic of the tax system of Saudi Arabia. According to Islam, it is considered

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[2]Ibid., pp. 3-4.

[3]SAMA Annual Report, 1973, pp. 16, 18.

as one of its five pillars.

(2) Income tax payable by foreign individuals at the following rate:

Net income in SR[4]	Tax rate
> 6,000 to ≤16,000	5 percent
>16,000 to ≤36,000	10 percent
>36,000 to ≤66,000	20 percent
>66,000	30 percent

(3) Income tax payable by foreign business enterprises and by foreign participants in Saudi companies:

Net income in SR	Tax rate
≤100,000	25 percent
>100,000 to ≤500,000	35 percent
>500,000 to ≤1,000,000	40 percent
>1,000,000	45 percent

(4) The oil companies have special regulations. These will be discussed in more detail later.

As a developing country, Saudi Arabia faced many difficulties in spending all of its huge annual income during the 1970s and early 1980s. This results from the large and rapid increase in oil earnings, on the one hand, and from the economy's limited absorptive capacity on the other. This will be explained in the following tables. Table 6.2 shows the rate of increase in the government revenue over the period of 1965 to 1982. The growth rate in government revenue over time is positive throughout the period, except in the years 1968, 1976 and 1979. This registered a very high rate of growth in many years, as shown by the table. In general, the growth rate in government revenue averaged

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[4]SR: Saudi currency (Saudi riyals).

Table 6.2. Total government annual revenues, annual oil revenues, and rates of growth (million U.S. dollars)[a]

Year	Total government revenues	Rate of growth	Annual oil revenues	Rate of growth
1964	597	--	524.2	--
1965	692	15.9	664.1	26.69
1966	880	27.3	789.9	18.94
1967	1114	26.9	903.6	14.39
1968	1097	-0.02	926.4	2.46
1969	1229	12	949.2	2.46
1970	1326	7.9	1214	27.90
1971	1427	6.9	1884.9	55.26
1972	2598	68	2744.6	45.6
1973	3577	22	4340.1	58.1
1974	6425	72.8	22573.5	420.1
1975	27911	330.7	25676.2	13.7
1976	27152	2	30754.9	19.8
1977	31516	15.7	36540.1	18.1
1978	43213	32.1	32233.8	-11.8
1979	38960	-11.3	48435.2	50.3
1980	64931	66.3	84466.4	74.4
1981	77372	21.0	101813.0	20.5
1982	99125	30	--	--

[a]Sources: National Accounts of Saudi Arabia, Issues 1981, 1982; SAMA Annual Report, 1972, 1975; Statistical Summary, 1969, 1982, 1979, 1977.

41.23 percent over the period 1965 to 1982.

Table 6.3 may be used as evidence explaining how the Saudi economy experienced an actual budget surplus during the period of 1970 through 1982. It is only in the years 1977/78 and in 1978/79 that the government budget experienced a deficit in which actual government expenditures exceeded actual government revenues (by percentages of 6, 7, and 10, respectively). The actual government expenditure on the average

Table 6.3. Actual revenues vs. actual expenditures (million Saudi Riyals)[a]

Year	Actual government revenues	Actual government expenditure	Expenditure as a percent of revenues
1969/70	5668	6079	107
1970/71	7954	6294	79
1971/72	11116	8130	73
1972/73	15325	10159	66
1973/74	41705	18595	44
1974/75	100103	32038	32
1975/76	103384	81784	79
1976/77	135957	128273	94
1977/78	130659	138048	106
1978/79	132871	147400	110
1979/80	211196	188363	89
1980/81	348100	236570	68
1981/82	366500	288200	79

[a]Sources: SAMA Annual Report, issues 1972/73, 1976. 1979; Statistical Summary, issue 1982.

through the whole period amounted to 79 percent of the actual government revenues through the same period.

As a result of the substantial increase in oil revenues, the government had the opportunity to collect a huge amount of foreign assets, especially after the oil boom in 1973. Saudi Arabia experienced small current accounts surpluses for most of the 1960s and large ones throughout most of the 1970s.[5] Estimates of the cumulative OPEC current account surpluses for 1980 ranged from $22 to 653 billion,

[5]Said Martan, "Domestic Development and the Management of Oil Revenues in the Economy of Saudi Arabia," Ph.D. Dissertation, University of Nebraska, Lincoln, Nebraska, 1980, p. 106.

with Saudi Arabia receiving about 50 percent of this amount.[6] This created another stream of income to the government through the earnings (or liquidation, if needed) of foreign assets. This source of income will become an important component in the structure of government revenues when current earning from oil exports and nonoil revenues fall short of financing governmental needs for the program of continued development. Since the data of such earnings are not available, nothing may be said except that they are an available source of government revenues when needed.

Many economists predict that the Saudi government will continue to receive foreign assets during the 1980s, as a result of the expected increase in the world demand for oil, and the rising price of it. However, this expectation was confronted by an unexpected oil market crisis in mid-1983 when the posted price of Saudi oil fell from $34 to $29 per barrel and the exports almost fell in half.[7] Saudi Arabia no longer has a clear idea of the future of the oil market, in terms of either prices or quantity demanded. Therefore, Saudi Arabia will face a budget deficit for the fiscal year 1983/84 if there is no positive change in the oil market. Gradual liquidation of the government's foreign assets may be required if government development programs are to be financed according to the Third Development Plan to maintain the planned rate of

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[6] Saudi Business and Arab Economic Report, Dec. 14, 1979, p. 27; also see A. K. Bhattacharya, The Myth of Pepopower, Lexington Books, Lexington, Mass., 1977, p. 13.

[7] Current production of crude oil is 5.5 million barrels a day. This is according to Saudi Report 5, No. 4 (December 5, 1983):4.

economic growth.

Historical Development of the Oil Industry in Saudi Arabia

Oil is by far the most important sector in Saudi Arabia's economy. Prior to the discovery of oil, the main sources of Saudi government revenues were customs duties on imports and fees paid by pilgrims to the holy cities of Makka and Madina. The economy was primitive and there was only small economic activity. With the discovery of oil in 1938 came a turning point in Saudi Arabia's economy. Saudi Arabia now owns nearly 25 percent of the total known reserves of crude oil.[8] The kingdom is clearly the largest producer of oil in the Middle East and the largest exporter in the world.[9]

It is worthwhile to give some historical background about the development of the Saudi Arabian oil industry.[10] The first company to be granted a concession, for a period of 60 years, was Standard Oil of California (SOCAL) in 1933. The government also agreed to grant SOCAL an exemption from all direct and indirect taxes, duties, etc., if SOCAL agreed in return to provide:

(1) Various loans, totaling £50,000 in gold;

(2) Annual rental of £5,000, until the discovery of oil; and

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[8]Robert E. Looney, Saudi Arabia's Development Potential, Lexington Books, D. C. Heath and Company, Lexington, Mass., 1982, p. 14.

[9]Ibid., p. 14.

[10]This historical background has been mostly taken from Said Martan, "Domestic Development and the Management of Oil Revenues in the Economy of Saudi Arabia," Ph.D. Dissertation, University of Nebraska, Lincoln, Nebraska, 1980, Chapter II.

(3) During production, the company was to pay a royalty to the government of about 20 cents per barrel.

Texaco and SOCAL merged in 1944 to form what is known today as the Arabian-American Oil Company (ARAMCO). Exxon and Mobil joined ARAMCO in 1947. Mobil now owns 10 percent, with the rest owning equal shares (i.e., 30 percent of ARAMCO each).

In 1949, another agreement was signed with Getty Oil, an independent company. Getty agreed to pay:

(1) Royalties of 55 cents per barrel of oil produced, with a 12.5 percent royalty from the sale of natural gas; and

(2) Twenty-five percent of the net profits from sales of oil refined outside the zone, and 20 percent of profits from oil refined within the zone.

In 1950, several revisions to these agreements were reached. The best known was the so-called 50-50 profit sharing principle, in which the government imposed an income tax on ARMACO's profit. With this tax, the total payments to the Saudi government would equal 50 percent of the company's net income. However, we should mention that among the costs that ARAMCO subtracted from gross income, from the sale of Saudi Oil, was the U.S. income tax paid by ARAMCO.

In 1952, ARAMCO agreed to provide a split of profits before paying U.S. taxes. However, this step was taken by ARAMCO after the U.S. government made it eligible for tax credit on overseas income. In 1957, the government signed an agreement with the Arabian Oil Company (AOC), which, in general form, said:

(1) Twenty percent of the oil produced, of the natural asphalt extracted, and of natural gas produced will be paid as a royalty; and

(2) The government's share of royalties and taxes must come to 56 percent of the company's net income from all operations inside and outside Saudi Arabia.

In 1965, ARAMCO agreed on "expensing of royalties"; i.e., to treat royalties, which were fixed at 12.5 percent of the posted price, as expenses deductible from gross income.

Petroming, a Saudi government corporation, was born in 1967. Small concessions were given it and in turn transferred to other companies.

In 1971, according to the Teheran Agreement between the oil companies and the oil producing countries, both agreed (among other things) to increase the base rate charged by producing countries to a minimum of 55 percent.

In 1973, Saudi Arabia acquired a 25 percent participation share in ARAMCO. In 1974, the participation in ARAMCO was raised to 60 percent. In November, 1974, the Persian Gulf countries increased the income tax on oil companies to 85 percent, and increased the royalty to 20 percent. By 1980, the Saudi government owned ARMACO completely. In return for this buy-out:

(1) Aramco will buy Saudi crude oil at a price below the world market price. The difference is treated as compensation for its 40 percent share. ARMACO is also expected to continue producing and marketing the Saudi Arabian oil until the concession agreement ends in 1999. A fee of 21 cents per barrel is charged for such services.

The above historical background is summarized in Table 6.4. ARAMCO is the dominant company in the area, producing an average of 95 percent of Saudi crude oil. Only the relationship between the Saudi government and ARAMCO is included herein, since the other companies are very minor and therefore have only small impact on the government's annual revenue, as compared to the impact of ARAMCO.

Table 6.5 explains the production of crude oil and the percentage shares of the oil companies in Saudi Arabia. ARAMCO's share increases over time ranged from 90 percent in 1964 to 98 percent in 1981. ARAMCO began taking more participation in oil production in 1971, when its share increased from 93 percent in 1970 to 94 percent. Its share jumped to 95 and 97 percent in 1972 and 1973, respectively. The share of the other companies, Getty and Arabian Oil, has decreased over time. In 1972, when the average daily production started to increase, the Getty and Arabian Oil companies produced an average of only one and two percent of Saudi's crude oil, respectively. Therefore, Table 6.4 provides a reasonable description of the development of the role of the oil industry in the Saudi Arabian economy.

The Possibility of Fitting a Government Revenue Function

Unlike the other sectoral equations, the government revenue function is influenced by the tax laws in the country. Hence, the institutional factors play an important role in forming the structure of the government revenue equation. This leads to the conclusion that the government revenue will be just the summation of the different items

Table 6.4. Historical development of the relationship between the Saudi government and ARAMCO

Years	GROR	GRTOC	GRO	GRT
1938-1949	a	o	o	a
1950-1951	a	b	o	(a+b)
1952-1964	a	c	o	(a+c)
1965-1970	d	e	o	(d+e)
1971-1973	d	f	o	(d+f)
1973	i	g	h	(d+g+h)
1974-1979	ℓ	k	j	(ℓ+k+j)
1978-1982	o	o	m	m

(a) $GROR = Q_T \times 20¢/barrel.$

(b) $GRTOC = 0.50\ [\pi_{PRIV} - T_{U.S.}]$

(c) $GRTOC = 0.50\ [\pi_{PRIV}]$

(d) $GROR = 0.125\ [P_{f.o.b.}\ Q_T]$

(e) $GRTOC = 0.50\ [\pi_{PRIV} - 0.125\ (P_{f.o.b.}\ Q_T)]$

(f) $GRTOC = 0.55\ [\pi_{PRIV} - 0.125\ (P_{f.o.b.}\ Q_T)]$

(g) $GRTOC = 0.55[.75\pi_T - .75(.125)P_{f.o.b.}\ Q_T]$

(h) $GRO\pi = 0.25\ P_{f.o.b.}\ Q_T - .25CQ_T$

(i) $GROR = (0.75)\ .125\ (P_{f.o.b.}\ Q_T)$

(j) $GRO\pi = 0.60\ P_{f.o.b.}\ Q_T - .60CQ_T)$

(k) $GRTOC = 0.85\ [.40\pi_T - .40(0.20)P_{f.o.b.}\ Q_T]$

(l) $GROR = 0.20\ (0.40)(P_{f.o.b.}\ Q_T)$

(m) $GRO = P_{f.o.b.}\ Q_T - .21\ (Q_T)$

where: GROR = Government revenue from oil royalty;

GRTOC = Government revenue from tax on oil companies;

GROπ = Government revenue from oil profit;

GRT = Total government revenue;

Q_T = Total crude oil produced;

π_{PRIV} = Profit of the oil companies;

$T_{U.S.}$ = U.S. government tax on oil companies; and

C_{QT} = Cost of production.

Table 6.5. Crude oil production by companies and their shares in the total oil production (million barrels)[a]

Year	ARAMCO		Getty		Arabian Oil		Total average	
	Production	% share	Production	% share	Production	% share	Production	Daily prod.
1964	628.1	0.90	34.4	0.05	31.6	0.05	694.1	1.90
1965	739.1	0.92	33.0	0.04	32.8	0.04	804.9	2.20
1966	873.3	0.92	30.2	0.03	46.1	0.05	949.7	2.60
1967	948.1	0.93	25.1	0.02	50.6	0.05	1023.8	2.80
1968	1035.8	0.93	23.2	0.02	54.7	0.05	1113.7	3.04
1969	1092.3	0.93	22.7	0.02	58.8	0.05	1173.9	3.21
1970	1295.3	0.93	28.7	0.02	62.6	0.05	1386.7	3.79
1971	1641.6	0.94	33.7	0.02	65.3	0.04	1740.6	4.76
1972	2098.4	0.95	28.5	0.01	75.0	0.04	2202.0	6.01
1973	2677.1	0.97	23.5	0.01	71.9	0.03	2772.6	7.59
1974	2996.5	0.97	29.8	0.01	68.7	0.02	3095.1	8.47
1975	2491.8	0.96	31.2	0.01	59.5	0.02	2582.5	7.07
1976	3053.9	0.97	29.7	0.01	55.7	0.02	3139.3	8.57
1977	3291.2	0.98	32.0	0.01	34.8	0.01	3358.0	9.20
1978	2952.3	0.97	29.4	0.01	56.3	0.02	3038.0	8.32
1979	3376.4	0.97	30.2	0.01	72.6	0.02	3479.2	9.52
1980	3525.2	0.97	28.5	0.01	70.6	0.02	3628.8	9.90
1981	3513.2	0.98	27.0	0.01	45.6	0.01	3585.8	9.82

[a]Source: SAMA Annual Report, 1975, p. 110; Statistical Summary, 1982, p. 64.

subject to government taxes, multiplied by the tax-rates. This leads to an identity, instead of usual functional form. However, if the government revenue is simply a summation of the value of taxable items multiplied by the corresponding tax rate, then one implicitly assumes that the tax system is 100 percent efficient. If this is so, there is no need for such an equation, because we are dealing with an identity. In fact, the tax system in any country, including MDCs, will not yield 100 percent results in terms of efficiency. Tax avoidance (by individuals or by firms) and the inability of the tax system to have a full idea of the tax base (especially in LDCs) may lead to overestimates of the actual value of collected government revenues if such an identity has been accepted without considering these factors. The error, therefore, will capture these disturbances, which reduces the explanatory ability of regressors in the government revenue function.

The tax system in Saudi Arabia is not that simple, as previously discussed. In fact, it is quite complicated. Therefore, there may be still more details to consider in the total sum of annual government revenue. How precise the oil companies are in reporting their actual income to the Saudi government is another issue which should be considered. In general, there is no detailed, documented information about how the tax is collected or what the right base is on which announced tax rates should be levied. The base we should use to determine the amount of taxes at the current year is another issue in constructing the government revenue function in general. Should we use the current income as a base, or lag it one period back? If the oil companies

delay payment until the end of their fiscal years, then the previous year's income should be considered as the regressor for use in determining the current year's government revenue.

On the assumption that identity will not apply to our case, we proceed to estimate the government revenue function. Since oil revenues are the main source to collect government revenues, oil companies' income is the correct base to select as a regressor. However, to fit a meaningful government function using the oil companies' income as a base, the closest we get to the oil companies' income in the country is by using the data reported by the American Oil Company in the Middle East by looking at various issues of the survey of Current Business Journal. Another attempt was made by multiplying the oil companies' income in the Middle East by the production share of Saudi Arabia to get the companies' approximated income in Saudi Arabia. The results were misleading and meaningless and we decided not to report it. One justification for the inappropriateness of these data is tax-shifting which is used by oil companies in an attempt to minimize their income tax paid to the U.S. government.

Finally, we used the export earnings as a regressor in the function and the following is obtained:

$$GR_t = -3424 + \underset{(6.6)}{.89}\ E_t \qquad \bar{R}^2 = 0.75$$

where: GR_t = Government current revenue

E_t = Current value of export.

As we can observe, the coefficient of E_t is significantly different

from zero (T-ratio is 6.6) and $\bar{R}^2$ is accepted (0.75). To interpret correctly the magnitude of the coefficient of E_t, we should have an idea about the nature of the value of exports. Is it including the oil companies' share or the net earnings of the government? The answer to this question was not found by reviewing the national income accounts of Saudi Arabia.

CHAPTER 7. FOREIGN TRADE SECTOR

Saudi Arabia depends heavily on foreign trade as a channel through which the country meets its need for goods and services. Crude oil exports provide the country with huge amounts of foreign exchange; however, crude oil is virtually the only export item. Domestic industrial and agricultural production are largely underdeveloped. Therefore, Saudi Arabia imports almost everything, including most of its very basic food items.

Import

Between 1975 and 1981, the value of imports increased more than seven-fold. In current value terms, import value increased from SR 22.25 billion to more than SR 160 billion ($6.3 billion to $47.5 billion, U.S.). This narrowed the Kingdom's trade surplus from SR 87.2 billion in 1975 to SR 45.4 billion in 1979.[1] It should be noted that the increase in import prices was one reason behind the reduction in trade surpluses. The surpluses increased in 1980 and 1981, to SR 126 and SR 206, respectively, due to high oil exports in the previous years which offset the shortfall in world supply resulting from the Iran crisis.[2]

The openness of the Saudi economy is illustrated by the high percentage of imports relative to the value of exports and GDP (Table 7.1).

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[1]Third Development Plan, Saudi Arabia Ministry of Planning, Riyadh, April 5, 1980, p. 49.

[2]SAMA Annual Report, 1981, pp. 21, 173.

Table 7.1. Saudi Arabia imports and its percentage of the Gross Domestic Product and the value of exports (Million Saudi Riyals)[a]

Year	GDP	Exports	Imports	Imports as % of GDP	Imports as % of exports
1970	17399	10302	4490	0.29	0.48
1971	22921	15189	5205	0.23	0.34
1972	26258	19862	6302	0.24	0.32
1973	40551	30012	8272	0.20	0.28
1974	99315	85682	15293	0.15	0.18
1975	139600	114461	27257	0.19	0.24
1976	164526	120284	48184	0.29	0.40
1977	205056	140321	62699	0.31	0.44
1978	225401	140762	91505	0.41	0.65
1979	249539	147236	107479	0.43	0.73
1980	385807	258488	132351	0.34	0.51
1981	521676	366713	160460	0.31	0.44

[a]Source: SAMA annual report, various issues.

Its share of exports and GDP increased steadily throughout the period 1970-1981, except in the years 1980 and 1981. The peak came in 1979, when 43 and 73 percent of GDP and exports, respectively, were used for import expenditures.

The composition of imports (consumer vs. producer goods) throughout the period 1980-1978 is shown in Table 7.2. Producer goods increased while consumer goods decreased. Consumer goods represented about 42 percent of the total imports, and 58 percent in 1970. In 1978, the respective percentages for consumer and producer goods were 23 and 74 percent. In 1981, almost half the Kingdom's total imports came from the U.S.A., Japan, and West Germany. Imports from the U.S.A. accounted for 21.4 percent of the total; those from Japan and West

Table 7.2. Saudi Arabia composition of imports (consumer goods vs. producer goods) (Million Saudi Riyals)[a]

Year	Consumer goods	Producer goods	Year	Consumer goods	Producer goods
1970	1320	1794	1975	4927	9692
	(.42)	(.58)		(.34)	(.66)
1971	1480	1863	1976	7624	22060
	(.44)	(.56)		(.26)	(.74)
1972	1684	2987	1977	13068	36943
	(.36)	(.64)		(.26)	(.74)
1973	2642	4391	1978	16152	53028
	(.37)	(.63)		(.23)	(.77)
1974	3672	6438			
	(.36)	(.64)			

[a]Source: United Nations Yearbook of International Trade Statistics, 1965-1979.

Germany constituted 18.3 and 9.6 percent, respectively.[3] The remainder of the import shares came from other European and industrial countries.

However, it is obvious that the developing countries are not the only ones which depend on imports to meet their needs for goods and services. The industrial countries also depend on foreign trade, not because they cannot produce such goods and services domestically but, rahter, because it is more efficient for them to trade. In general, if a country may gain from international trade, then it is economically beneficial for that country to trade, specializing in what it is best able to produce.

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[3]Statistical Summary, 1982, p. 33.

However, while a nation may gain enormously by involving itself in trade, one should remember the negative consequences of heavy dependency on the rest of the world. This puts the domestic economy at the mercy of outside factors which cannot be controlled by the country. Therefore, local provision for very basic items of food should be considered important from the political, as well as the security, point of view even if these items can be imported at lower prices.

Theoretical Analysis

It is well-known among economists that the import equation can be conventionally specified in general form as

$$M = f(Y, R, P_m/P_D) \tag{7.1}$$

where:

M = the total import;

Y = the domestic income;

R = the exchange rate; and

P_m/P_D = the relative prices (i.e., the ratio of the price of the imported goods to the domestic price level);

and

$\partial M/\partial Y > 0$

$\partial M/\partial R < 0$

$\partial M/\partial (P_m/P_D) < 0.$

However, equation 7.1 can be reduced to include only two independent variables instead of three. Since R is defined as the domestic currency

per unit of foreign currency, the relative price ratio (P_m/P_D) can be expressed either in terms of domestic currency or foreign currency. Hence, equation 7.1 can be rewritten as:

$$M = f[Y, (P_m/P_D)R] \tag{7.2}$$

Some argue that the relationship between the change in domestic income and imports is not necessarily positive. In fact, they argue that it could be positive or negative depending on the magnitude of the domestic supply elasticity relevant to the domestic demand elasticity. If the first elasticity is greater than the second, it is likely to have a negative influence on imports if the domestic income increases.

One could say a priori that it will be positive in the case of Saudi Arabia since almost all the country's needs are imported from the outside and there are no adequate domestic substitutes, as previously discussed. As for the relative price, many studies confirm its importance and reject the unrealistic assumption that imports of developing countries are determined by nonmarket factors.[4]

Data

The following define the variables used in estimating the import function of Saudi Arabia. These variables are:

M_t = Total value of current imports;

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[4] Omar Hafiz, "A Foreign Trade Model for Saudi Arabia: An Econometric Approach," Ph.D. Dissertation, Indiana University, Bloomington, Indiana, 1981.

Y_t = Current Gross Domestic Product;

RPD_t = Relative price (P_m/P_D), where P_m is the import unit value index and P_D is the implicit GDP deflator[5];

E_t = The value of exports.

All of the above variables were used in real terms by deflating them with the appropriate deflator. Table 7.3 represents the data used in the estimation.

Table 7.3. Data used in estimating the import function (million Saudi Riyals)[a]

Year	M_t	Y_t	RPD_t[b]	E_t
1969	4851	15975	215	9086
1970	4990	17399	225	10302
1971	5205	22921	201	15189
1972	6302	28258	189	19862
1973	8272	40551	175	30012
1974	15293	99315	105	85682
1975	27257	139599	80	114461
1976	42863	164526	76	120284
1977	62699	205056	77	140321
1978	91505	225401	78	140762
1979	107479	249539	87	147236
1980	132351	385807	78	258488
1981	160460	521675	57	366713

[a]Sources: Statistical Summary, issues 1977, 1979, 1980, 1981, 1982; International Financial Statistics, IMF, Various issues.

[b]RPD = Import unit value Index ÷ GDP deflator.

[5]Since RPD = P_m/P_D where P_m is the price of imports and P_D is the domestic price, one should expect a negative relationship between RPD and the imports.

Specifications and Estimations of Equations

The following import function forms were applied:

$$M_t = \delta_0 + \delta_1(Y_t) + e_t \quad (7.3.a)$$

$$M_t = \delta_0 + \delta_1(Y_{t-1}) + e_t \quad (7.3.b)$$

$$M_t = \delta_0 + \delta_1(Y_t) - \delta_2(RPD_t) + e_t \quad (7.3.c)$$

$$M_t = \delta_0 + \delta_1(E_t) - \delta_2(RPD_t) + e_t \quad (7.3.d)$$

$$M_t = \delta_0 + \delta_1(Y_{t-1}) - \delta_2(RPD_t) + e_t \quad (7.3.e)$$

$$M_t = \delta_0 + \delta_1(E_{t-1}) - \delta_2(RPD_t) + e_t \quad (7.3.f)$$

$$M_t = \delta_1(Y_{t-1}) - \delta_2(RPD_t) + e_t \quad (7.3.g)$$

$$M_t = \delta_1(E_{t-1}) - \delta_2(RPD_t) + e_t \quad (7.3.h)$$

$$\log M_t = \theta_0 + \theta_1 \log (E_t) - \theta \log (RPD_t) + e_t \quad (7.3.i)$$

$$\log M_t = \theta_0 + \theta_1 \log (Y_{t-1}) - \theta \log (RPD_t) + e_t \quad (7.3.j)$$

$$\log M_t = \theta_0 + \theta_1 \log (E_{t-1}) - \theta \log (RPD_t) + e_t \quad (7.3.k)$$

Other variables may be relevant to the import function. Such variables are: foreign exchange and restrictions or credits that the government uses as a policy to influence imports. Also, the income of specific groups in the country may directly influence imports. The decision was made to exclude these variables from analysis due to either their irrelevance to the economic characteristics or insufficient data for the period under study. We hope to perform more complicated analyses in the future.

Statistical Results

Statistical results are summarized in Table 7.4. Analysis began with the simple assumption that Gross Domestic Product (Y_t) is the only factor which explains variability in imports. Equation 7.3.a provides very nice statistical results. The coefficient of Y_t is very significant; the value of t-ratio is equal to 7.22. The adjusted R-square is also acceptable (.83). To yield a more acceptable estimate, the variable was lagged one year (Y_{t-1}) and put into the model again (equation 7.3.b). The result was almost the same as in 7.2.a.

Since the relative price ratio plays an important role in determining the imports of a developing economy, both Y_t and the relative price ratio (RPD) were treated as independent variables. Equation 7.3.c resulted from this treatment, but the specification was rejected because the coefficient of RPD was incorrect.

Since exports are an important source of income, the value of exports (E_t) may be used instead of Y_t in equation 7.3.d. The signs of the coefficients are as expected a priori. However, this specification was also rejected because the t-ratios and $\bar{R}^2$ were very low. The same variables were tested in equations 7.3.c and 7.3.d., but in the lagged form of Y_t and E_t (Y_{t-1}, E_{t-1}). The specification, as shown in equation 7.3.3, gives the wrong signs for RPD. This is cause to reject it. The specification, as shown in equation 7.3.7, yields the correct sign for both variables, but the coefficient of RPD is not significantly different from zero. Equations 7.3.e and 7.3.f were reproduced with no

Table 7.4. Statistical results: Dependent variable is import (M_t)

Equation	Intercept	Y_t	RPD	E_t	Y_{t-1}	E_{t-1}	$\bar{R}^2$	F
7.3.a	-41194 (-3.32)[a]	0.56 (7.22)					0.83	
7.3.b.	-35010 (-3.21)				0.57 (8.16)		0.87	
7.3.c	-71633 (-2.2)	0.68 (5.34)	7611 (0.84)				0.89	50
7.3.d	58852 (0.98)		-21067 (-1.16)	0.18 (0.57)			0.50	
7.3.e	-67497 (-2.35)		9428 (1.12)		0.69 (5.88)		0.90	
7.3.f	-10103 (-0.18)		-1774 (-0.10)			0.60 (1.91)	0.65	
7.3.g			-10944 (-4.04)		0.43 (13.24)		0.95	
7.3.h			-8631 (-2.13)			0.59 (8.28)	0.88	

Equation	Intercept	log RPD	log E_t	log Y_{t-1}	log E_{t-1}	$\bar{R}^2$
7.3.i	8.165 (1.34)	-1.37 (-2.74)	0.22 (0.41)			0.74
7.3.j	-9.58 (-1.46)	-0.36 (-0.82)		1.69 (3.09)		0.88
7.3.k	1.43 (0.18)	-0.80 (-1.18)			0.79 (1.13)	0.76

[a]Values in parentheses are the t-ratios.

intercept in equations 7.3.g and 7.3.f, and the results are as follows. Both specifications yield a very nice statistical result. $\bar{R}^2$ are high, especially in equation 7.3.a (0.95). The t-ratios are high, especially for Y_{t-1}. There is still a problem with the magnitude of the coefficients in these specifications. The percentage of imports to GDP (Y_t) through the period under study averaged 28 percent.[6] Therefore, the coefficient of Y_{t-1} is considered to be overestimated and not a representation of the true estimate. The coefficient of E_{t-1} is also overestimated, since the percentage of imports to exports averaged 41 percent. Should we select one of the equations in Table 4.7, equation 7.3.h is the best overall.

Table 4.7 also contains some of the specifications in log form. The best log specification in Table 4.7 is equation 7.3.k. The elasticity of import with respect to export (.79) is reasonable in our case. However, we would prefer equation 7.3.h to 7.3.k, in spite of its weaknesses, because it has higher $\bar{R}^2$ and its coefficients are more significantly different from zero. The analysis of the import function concluded with this specification, at least at this stage, hoping that it could be improved in the future.

Exports

Oil is the only commodity exported by Saudi Arabia. Saudi Arabia is recognized by its large oil reserves. As we mentioned previously, about 25 percent of the world oil reserves are estimated to be in Saudi Arabia. It is the largest oil exporter in the world. It exported

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[6]Derived from Table 7.1.

about 45 percent of the OPEC members in 1982. The country since 1974 until early 1983, with the exception of a few years, was not able to absorb all of the oil revenues and hence a tremendous amount of foreign exchange was accumulated. Oil export is subject to factors other than economics. Political as well as economic factors, on one hand, and the characteristics of the international oil demand, on the other, make it difficult to relate the exports of Saudi Arabia with the influence of traditional factors, such as the income of oil importing countries and the price of oil relative to their domestic prices. Nonquantitative variables should be considered in fitting an equation for the exports of Saudi Arabia. Transfer of advanced technology, political gains, military gains to insure the internal as well as the external stability of the kingdom, factors influencing the decision of OPEC members, etc., are among the variables influencing the decision of oil exports. Oil is a very important commodity for the importing oil countries. Oil is not only a source of energy but can be used as a raw material for producing many products. In addition, they should insure a minimum level of oil reserves for security reasons.

There will be no modeling for the export function at this stage and we hope to explore this issue more in the future. We will stop at this first step, hoping for further steps to take place to explore this issue more in the future.

CHAPTER 8. CONCLUSIONS

Saudi Arabian economy, as a typical oil economy, has a unique feature which is not found in most of developing countries. An example of that is the abundancy of capital and the scarcity of labor factor. About 20 years ago, the economy was primitive and lagged behind. After the oil discovery and the oil exports in commercial quantities, the country started to notice a very rapid growth rate which highly exceeded the rate of growth of any nonoil developing economy. Real growth rate of Gross Domestic Product was growing at a rate of 10 percent on the average during the period of the first and second development plans (1970-1980). The economy was able to build a lot of the infrastructure projects (roads, airports, etc.) within a short period in the age of countries. In spite of that, bottlenecks do exist in some sectors, as we observed previously.

The equations of the different sectors are not satisfactory, as we expected a priori. Data problem is among the factors hindering the precision of the study. In spite of that, the following conclusions are in order:

(1) There should be a distinction between the marginal propensity to consume of Saudis and non-Saudis. This led to the conclusion that fitting a consumption function for the private sector without considering this phenomenon will lead to misleading results and unreliable conclusions. This might be one of the reasons behind the underestimation of the MPC in our study.

(2) Interest rate and other traditional factors influencing investment in other countries might not be an appropriate variable in Saudi Arabia, at least up to this time. Most of the investment went to nonmanufacturing investment due to the need for building a strong base so industrialization could take place. The majority of the investment in the country is conducted by the government since this type of investment is beyond the capability of the private sector.

(3) In terms of government revenue structure, the major source of income is the oil revenues. Income tax on individuals as well as all other income taxes except of oil companies is almost negligible and has an unimportant impact on the government budget.

(4) The imports of the country are the source of almost everything in the country. Without imports, development in the country would be hindered severely. The oil export is a major determinant of the country's imports. Relative prices and exchange rate also have an impact on it.

(5) We did not try to model the export function for the simple reason that traditional factors may not play an important role as regressors, and other nonquantitative variables should be incorporated in the function.

(6) Multicollinearity, as well as the autocorrelation problems, are among the problems faced in the study. The correction for autocorrelation did not yield a major change in the decision to select the appropriate specification, and that might be due to the small sample size which deprives us from the large size sample property.

Finally, further elaboration of the study with a good data base is suggested for future research. Elaboration should consider the inclusion of the period after the oil market crisis in mid-1983.

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APPENDIX

Data Sources

Poor data base is one of the main problems confronting any study about almost all of the developing economies. Poor data base and more disaggregated form of data are the main problems to this study. The time period for this study covers the period of 1970-1981. The study intended to study a more extended period, but the availability of more data before and after the period of study makes it impossible, at least for some of the variables used in the study.

Most of the data provided by the government agencies are primarily given in the Muslim Hijri calendar, which is the official calendar of Saudi Arabia. The Hijri calendar is a lunar calendar which starts with the time of the migration of the prophet Muhammad, peace be upon him, who migrated from Makka to Madina in 622 A.D. A conversion of Hijri years to Gregorian years has been applied. As an example, the year of 1398/99 in Hijri is approximated by the year of 1979 in Gregorian.

The data used are in Saudi currency (Saudi Riyals) where the exchange rates are as follows:

1963-1970	$1 = 4.5 SRs
1971	$1 = 4.47 SRs
1972	$1 = 4.15 SRs
1973	$1 = 3.69 SRs
1974	$1 = 3.55 SRs
1975	$1 = 3.52 SRs
1976	$1 = 3.53 SRs
1977	$1 = 3.52 SRs
1978	$1 = 3.39 SRs

1979	$1 = 3.36 SRs
1980	$1 = 3.33 SRs
1981	$1 = 3.38 SRs
1982	$1 = 3.43 SRs

The principal sources of the data are as follows:

(1) National Income Accounts of Saudi Arabia issued by the Central Department of Statistics, Ministry of Finance and National Economy.

(2) Saudi Arabia Monetary Agency (SAMA) annual reports.

(3) Statistical Summary, Saudi Arabia Monetary Agency.

(4) International Financial Statistics, IMF.

Table A.1. Price indexes, 1975 = 100[a]

Year	CPI	GDP deflator	Import unit value index
1969	0.48	0.23	0.61
1970	0.48	0.23	0.64
1971	0.50	0.26	0.66
1972	0.53	0.28	0.66
1973	0.61	0.34	0.73
1974	0.74	0.71	0.94
1975	1.00	1.00	1.00
1976	1.32	1.09	1.02
1977	1.47	1.17	1.13
1978	1.44	1.22	1.18
1979	1.47	1.26	1.38
1980	1.52	1.65	1.60
1981	1.56	2.23	1.58

[a]Sources: IMF, International Financial Statistics Supplement, 1982; IMF, International Financial Statistics, various issues; SAMA, Annual Reports, various issues.

Table A.2. Income of the U.S. foreign investors (millions of $)[a]

Year	Developed countries	Developing countries	Latin America	Other countries	Middle East countries	Index
1966	133	1297	460	838	863	60
1967	206	1415	470	446	983	68
1968	192	1632	492	1140	1079	75
1969	224	1622	389	1232	1133	79
1970	485	1567	357	1210	1178	82
1971	541	1997	447	1550	1856	129
1972	594	2255	247	2008	1358	94
1973	1739	3632	805	2827	2155	160
1974	1891	4653	762	3892	8431	585
1975	1642	3071	427	2643	1441	100
1976	1931	2970	449	2521	1659	115
1977	2107	3497	623	2874	1607	112
1978	2541	3230	527	2703	1483	103
1979	6962	6333	1392	4940	2445	170
1980	8636	4138	961	3176	-338	-23
1981	7131	5468	1052	4416	1022	71

[a]Source: Survey of Current Business issues (1967-1982).