A Static Macro Model for The Saudi Economy: 1970-1985

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ABSTRACT. This is an introductory survey of the Saudi Arabian national economy. It provides a brief exposition to a vigorously growing and rapidly changing economy, which has come to play a very significant role on the international scene. Saudi Arabia is a strong example of direct government involvement in national economic development. Massive oil fortunes were successfully and directly used through the public sector to transform a primitive economy into a modern industrial complex.

The study tests several basic economic relationships to determine the patterns of behavior for consumption, investment and the money markets in the Saudi economy. It uses econometric tests to isolate several significant relationships and contributes to the available literature on the topic.

As expected, the study documents the dominance of fiscal variables. It shows government expenditures as the variable exhibiting the most significant effect on the national economy. The study also, presents an estimate of the multiplier of expenditures and of the velocity of money. These estimates also fall with conventional expectations for developing economies. However, the study failed to detect any significant effect for the interest rates it tested on economic variables.

Introduction

The Saudi economy has witnessed a spectacular rate of growth and development in its various sectors. This has allowed it to jump to the present position of an advanced and international economy, competing in the open markets with various other producers.

This impressive transformation occurred within a seemingly impossible time period of less than fifty years. Accounts of Saudi Arabia at that time illustrate the vast changes that have occurred in these years:

> "In 1940 the wheel was not in general use in most areas of the nation. Saudi Arabia had a pastoral economy based on the raising of goats, sheep and camels. The majority of the urban population lived in small villages built of mudbrick and earned a living from subsistence agriculture. The nomads drove their herds of animals across the desert in search of forage, carrying their meager belongings on camel back from grazing area to grazing"[1].

The thrust of development came in the past twenty-five years. The oil boom of the 1970s and the combined effect of increasing prices and increasing production of Saudi crude led to rapid and successive jumps in government income. These revenues were in turn channeled to the various national development. plans and towards the growth of the national economy.

During the past twenty years the government managed to direct about SR2 trillion towards national development and growth. This massive public spending led to the overhaul of the national economy and was directly responsible for the vast development in its various sectors.

Yet, inspite of the challenges faced by the Saudi economy and its unique experience in development and growth, there have been relatively few studies on it. Dr. Fisal Al-Basheer was a pioneer in this field presenting an econometric study of the Saudi economy for the period 1960-1970 (Al-Basheer 1977).

Although Dr. Bashir's study breaks new ground and provides valuable insight on the workings of the Saudi economy, it unfortunately ends by 1970. Meanwhile, the Saudi economy experienced its highest rates of growth and development in the 1970s, When oil prices, production and revenues hit record highs. Thus, it is quite important to include this period in any analysis of the Saudi economy.

Other studies on the Saudi economy include Looney's (1982); which tested and presented several economic relations for some sectors of the Saudi economy, but did not produce or test a general model. El-Mallakh and El-Mallakh also isolate various economic relationships (El-Mallakh and El-Mallakh 1982); and, Hafiz and Darrat present an econometric study for the Saudi monetary sector, (Hafiz and Darrat 1983). But, none of these last studies is comprehensive in its look to the Saudi economy, nor do they extend to cover the period of our present study.

The present paper tries to shed more light on the Saudi economy. It updates previous studies by extending its scope to the year 1985 and extends the analysis towards a general view. It also serves to test and present new findings as well as confirm or retest the findings of the earlier studies. It will illustrate, as we shall seem the course of its findings that there are special features of the Saudi economy, chief among which is the dominance of fiscal factors and national revenue. This is not a surprising result in an economy where the government has funneled over SR 2 trillion to finance development.

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(1) **Romam Knaverhase**, *The Saudi Arabian Economy*, **Praeger** Publishers,. N.Y., 1978, p. 57.

The Model

Here, we present a simplified static macro-economic model for the Saudi economy. Our purpose is to find and isolate significant relations among the various economic variables and estimate the effect of government expenditures or the fiscal multiplier from basic macro equations.

A. The Consumption Function

We expect a positive and significant relationship between consumption expenditure to both current and lagged income; Here, income is measured by the gross national product and consumption is measured by total government and private consumption in the Saudi economy.

Formally,
Consumption = F (income, lagged income)

$$C = f(Y_t, Y_{t-1})$$

$$\frac{\partial C}{\partial Y_t} > 0$$

$$\frac{\partial C}{\partial Y_{t-1}} > 0$$

B. The Investment Function

A strong positive and significant relation is expected between investment expenditures and gross income. Investments are directly dependent on gross revenues and the state of economic activity. The large and direct role of the public sector in this area is quite evident. The Saudi government has started since 1970 a series of ambitious five-year development plans for its economy that allocated a continuous flow of investment in its various sectors.

But, contrary to conventional economic theory we expect no significant relationship between investment and interest rates. Although this contradicts general expectations, it is not unusual for the Saudi economy. Interest rates are shunned by the great majority of the Muslim Saudi populace and the national money markets have only recently been developed.

However, one could argue that the presence of some other returns on investments, such as government guaranteed dividends on stock holdings in public companies, e.g. electricity companies, returns on investments in real estate and land speculations, profits from retail merchandising and speculations in gold and currency markets. Those activities have witnessed speculative growth during the study period and it is our belief that a composite rate of return must have come to play during the period.

For these reasons it is not surprising to find no significant effect for commercial bank's interest rates on Saudi investment decisions. Nevertheless, we included them as determinants in the investment function to test our expectations.

Formally:

Investment = F (income, interest rate)

$$I = f(Y, r)$$

$$\frac{\partial I}{\partial Y} > 0$$

$$\frac{\partial I}{\partial r} < 0$$

C. Imports

Conventional economic theory leads us to expect a strong positive and significant relation between income and imports. The demand for goods whether for consumption or investment purposes is closely linked to the income and growth of any economy.

This is especially true of the young but vastly developing Saudi economy which had to turn to outside markets to satisfy its requirements of both consumption and capital goods.

Formally:

Imports = F (income)

$$M = f(Y)$$

$$\frac{\partial M}{\partial Y} > 0$$

D. The Monetary Market

Economic theory links money demand to two main needs, transactional demand for money which is dependant on the level of economic activity and speculative demand for money which is related to the level of returns or interest rates on investments. i.e. the cost of holding money is the forgone return from holding other assets.[2]

Thus, money demand becomes a positive function of economic activity as measured by gross national product and a negative function of interest rates. At equilibrium this demand is equal to money supply which could be measured by a multitude of variables. We chose to measure money supply for the Saudi economy by *M3*. We chose this broad measure of money supply to capture as much as possible the vast and varied growth of the Saudi monetary system.

Formally:

Money Demand = *F* (income, interest rates)

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(2) Precautionary demand for money is also related to the level of economic activity.

Money Supply = Money demand = M* at equilibrium

$$Md = f(Y, r)$$

$$Ms = Md = M^* \text{ at equilibrium}$$

$$M^* = f(Y, r)$$

$$\frac{\partial M^*}{\partial Y} > 0$$

$$\frac{\partial M^*}{\partial r} < 0$$

Empirical Tests and Results

A. Consumption Function

$$C = C_0 + c_1 Y_t + c_2 Y_{t-1}$$

C = -6734 +	.17Y_t +	.51Y_{t-1}	(Eq. 1)
(-0.67)	(1.67)	(5.32)	
1970-1985	RSQ: .974	D-W:1.44	
C= -13.471 +	.18Y_t +	.52Y_{t-1}	(Eq. 2)
(-2.27)	(1.77)	(4.92)	
1970-1985	CRSQ: .9884		

Equation two corrects for the autocorrelation in equation one.

As equation two show over half of lagged income and about twenty percent of current income is spent on consumption. Thus, the Saudi economy devotes about seventy percent of its income to consumption, with about two-thirds of this consumption flow resulting from last year's income.[3]

The results of equation two were obtained after Correcting for autocorrelation which was present in the original form of the equation (equation one), and which adversely affected the statistical significance of the results. Such autocorrelation was present in all of our tests and was corrected in the same method.

The strong lagged effect of income could be due to the pattern of oil receipts and expenditures by the government. Oil revenues form the main source of income for the Saudi economy, but there is a lag from the period of oil sales to actual payments to the government and its allocation in annual fiscal budgets. Also, frequent and large surpluses or deficit budgets lead to a "carry over" effect of current income on future expenditures or consumption.

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(3) Our consumption equations used total consumption figures and not private consumption. A private consumption equation was tested and produced an estimate of about 0.3 for the marginal propensity to consume.

The results of our statistical run also showed a negative and significant intercept for the consumption function, which contradicts our expectations. However, it may be the result of strong upward shifts in Saudi consumption behavior, or a series of breaks in the consumption function. This is definitely a valid suggestion taking into considerations the drastic jumps in Saudi income during the fifteen years we are studying and especially in the mid to late 1970s. These sudden and drastic changes in income could have led to similar changes in consumption. Therefore, we would suggest that further studies try to test this hypothesis.

We expect that these tests will show the consumption functions shifting upward overtime with every similar slopes or marginal propensities to consume, but with in creasing intercepts or higher autonomous consumption levels as expectations or consumption patterns are raised.

B. The Investment Function

$$I = I_0 + i_1 Y - i_2 r$$

$$I = -22,606 + \quad .192Y + \quad 4.417r \qquad \text{(Eq. 3)}$$
$$\quad (-1.53) \qquad (5.591) \qquad (1.97)$$
$$1970\text{-}1985 \qquad \text{CRSQ: .944} \qquad \text{D-W: .92}$$

$$I = -23,248 + \quad .19Y + \quad 4,408r \qquad \text{(Eq. 4)}$$
$$\quad (-1.46) \qquad (5.15) \qquad (1.77)$$
$$1970\text{-}1985 \qquad \text{CRSQ: .953}$$

Equation four corrects for the autocorrelation in equation three. [4]

Equation four shows that about twenty percent of Saudi income is invested. This is quite an unusually high figure, but is according to expectations in a newly and rapidly developing country with vast financial resources and vaster potential for investments

At the same time Equation 4 does not show that interest rates are significant, the coefficient "i_2" is of the wrong expected sign and is not statistically significant at the 90 percent level of confidence.

C. The Imports Function

$$M = M_0 + m_1 Y$$

$$M = -5,636 + \quad 0.29Y \qquad \qquad \text{(Eq. 5)}$$
$$\quad (-0.97) \qquad (14.02)$$
$$1970\text{-}1985 \qquad \text{CRSQ: .938} \qquad \text{D-W:1.05}$$

$$M = -8,514 + \quad 0.29Y \qquad \qquad \text{(Eq. 6)}$$
$$\quad (-1.22) \qquad (10.92)$$
$$1970 - 1985 \qquad \text{CRSQ: .994}$$

Equation six corrects for the autocorrelation in equation five.

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(4) interest rates on U.S. dollar one month deposits offered in London were used as a proxy for interests on SR deposits.

As our statistical tests show, the Saudi economy annually spent about one third of its GDP to pay for its imports bill. This is quite a significant amount, but is not surprising as most of the products that were demanded by the rapidly growing Saudi economy had to be imported. Goods for investment demand and to meet the raising standard of living could not be produced by the young Saudi economy.

D. The Money Function

$$M^* = M_0^* + m_1^* Y - m_2^* r$$

$M^* = 21{,}910 +$	$.35Y -$	$4{,}532r$	(Eq. 7)
(0.74)	(4.60)	(-0.90)	
1970-1985	CRSQ: .908	D-W.723	
$M^* = 5{,}456 +$	$0.32Y -$	$2{,}012r$	(Eq. 8)
(0.09)	(2.07)	(-0.19)	
1970-1985	CRSQ: 0.963		

Equation eight corrects for the autocorrelation of equation seven.

As our statistical results show, we find that GDP is a strong and significant determinant of money stock in the Saudi national economy. This result confirms conventional economic theory, but unlike expected economic theory we encounter evidence of the insignificance of interest rates in the Saudi economy.

Money demand does not seem affected by the level of interest rates. Although the sign of the relationship is negative as expected, the relationship itself is not statistically significant.

The transactions coefficient is about .33, which would make the velocity of money in the Saudi national economy very close to three. This is quite in line with velocity estimates for *M3* in various other developing economies.

The Multiplier

Now that we have derived the basic macro equations for the Saudi economy we may estimate its multiplier.

$$Y = C + I + X - M$$
$$Md = Ms = M^*$$

where :

$$C = C_0 + c(Y)$$
$$I = I_0 + i(Y,r)$$
$$X = \overline{X}$$
$$M = M_0 + m(y)$$
$$M^* = M^*(Y,r)$$

the statistical results for these equations were:

$$C = -13,471 + 0.18\ Y + 0.52Y \qquad \text{(Eq. 2)}$$

$$I = -23,248 + 0.l9\ Y + 4,408\ r \qquad \text{(Eq. 4)}$$

$$M = -8,514 + 0.29\ Y \qquad \text{(Eq. 6)}$$

$$M^* = 5,456 + 0.32\ Y - 2,012\ r \qquad \text{(Eq. 8)}$$

at equilibrium

$$Y = [C_0 + c(Y) + I_0 + i(Y,r) + \overline{X} - M_0 - m\ (Y)\ ]$$

$$M^* = M^*(Y,r)$$

or

$$dY = dC + \frac{\partial C}{\partial Y}\,dY + dI + \frac{\partial I}{\partial Y}\,dY + \frac{\partial I}{\partial r}\,dr + dX - dM - \frac{\partial M}{\partial Y}\,dY$$

and

$$dM^* = \frac{\partial M^*}{\partial Y}\,dY + \frac{\partial M^*}{\partial r}\,dr$$

or

$$dY = (\,dC + dI + dX - dM + dM^*\ \frac{\partial I}{\partial r}\ /\ \frac{\partial M^*}{\partial r}\,)\,/$$

$$(1 - \frac{\partial C}{\partial Y} - \frac{\partial I}{\partial Y} + \frac{\partial M}{\partial Y} + \frac{\partial I}{\partial r}\ (\partial M^*/\partial Y/\partial M^*/\partial r))$$

and we can substitute our obtained coefficients for the equation values, knowing that $\frac{\partial I}{\partial r}$ and $\frac{\partial M^*}{\partial r}$ are not significantly different from zero, therefore:

$$dY = (dC + dI + dX - dM)\ /\ (1 - 0.70 - 0.19 + 0.29)$$

$$dY = (dC + dI + dX - dM)\ /\ 0.40$$

therefore the multiplier equals 2.5, or a one Saudi Riyal increase in government expenditure, consumption or investment should lead to a 2.5 Riyal's growth in GDP.

Conclusion

We estimated a general and simple form of a proposed economic relationships for the Saudi economy. Ordinary least square equations were derived to isolate the link between these variable and their determinants. After correcting for a persistent autocorrelation problem we found that the dominant force in the Saudi economy is gross income, which is mainly determined by the level of government expenditures.

Consumption is determined mainly by income, interest rates seem to have no significant effect. Investment is determined by ability to invest (income) and not by the various alternative returns available (interest rates).

Export are exogenous in the Saudi economy, being more a factor of external events than a result of internal causes - OPEC and world demand for oil and its price stability will probably affect the Kingdom's export revenue more than anything else. From the above results we note a few important conclusions: First, it seems that interest rates have no significant effect whatsoever on the Saudi economy. They were not statistically significant even in testing for a relation with monetary variables such as money demand.

This is quite an interesting result and contradicts established economic theory as well as other studies on the Saudi economy which managed to isolate a significant impact for interest rates (Hafiz and Darrat 1983) [5]. We could, however, explain this lack of significance of interest rates due to several factors. First, the Saudi populance is predominantly Muslim and is thus bound by religion not to deal with interest in giving or receiving money. Second, the Saudi economy is just beginning to develop and as such has yet to provide mature and international financial markets sensitive to national or international interest returns and capital movements. Third, the Saudi economy has been endowed with vast oil wealth and revenues which were directly and strongly used by the government to finance massive development and expenditure projects. These national projects and expenditures were not sensitive to interest rate changes, for they were financed and spent locally. This result was discussed before as we suggested the existence of a proxy rate of return which affects investment decisions.

Therefore, we suggest a detailed study of the investment decision function with an emphasis on a distinction between the household sector, the private sector and the government investment activities.

This point brings us to the second main observation of this study which showed a marked dominance of fiscal variables as well as the total lack of significance of monetary variables. National income as determined by government expenditures is the main force of the Saudi economy. This is the case with the exception of exports which are mainly composed of oil exports and which are in turn determined more by international rather than national events.

The study also uncovered good areas for future research. It would be interesting to use real variables instead of nominal ones as used in this study. Deflating these variables would remove the effect of price changes on the tested relationships. However, one would need accurate price indices and comprehensive data to be able to remove the effect of price changes.

Furthermore, as we suggested earlier it would be worthwhile to further break our data sample to cover the different periods in the Saudi economy. This economy has witnessed rapid growth and as such its economic relationships could have easily changed over time. One needs to test for such changes by testing the same relations over different time periods. However, for this we need more detailed data than the annual figures we now have.

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(5) In their study of money demand for the Saudi economy for the period 1967-1979, Hafiz and Darrat found that foreign interest rates are very significant in achieving stability of the Saudi money demand equation, (Hafiz and Darrat, 1983, p. 19).

Also, for future research we recommend using a simultaneous equations approach in a general equilibrium model to further sharpen the results of our tests and isolate with a higher degree of accuracy the relationships among Saudi economic variables.

References

Al-Basheer, Faisal Safouq, *A Structural Econometric Model of the Saudi Economy*, 1960-1970. New York: John Wiley & Sons, 1977.

Central Planning Organization, *Kingdom of Saudi Arabia Development Plan*, 1390 A.H.

EI-Mallakh, Racagi, EI-Mallakh, Dorothea K., *Saudi Arabia, Energy Developmental Planning and Industrialization*. Lexington: D.C. Heath & Co., 1982.

Hafiz, Omar Zoheer and **Darrat, Ali Farag,** *A Monetary Model for Inflation in the Saudi Economy*. Jeddah: Center of Seientific Research, King Abdulaziz University, 1983.

Looney, Robert E., *Saudi Arabia's Development Potential*. Lexington: D.C. Heath & Co., 1982.

Ministry of Planning. Kingdom of Saudi Arabia, *The Second Development Plan (1395-1400 A.H. 1975- 1980 A.D.)*.

Ministry of Planning. Kingdom of Saudi Arabia, *Third Development Plan (1400-1405 A.H/ 1980-1985 A.D.)*.

Ministry of Planning, Kingdom of Saudi Arabia, *Fourth Development Plan (1405-1410 A.H./ 1985-1990 A.D.)*.

The Europe Year Book, A World Survey, *Europa Publications Ltd.,* London, Vol. **11** of years 1960-1986.

The International Monetary Fund, *International Financial Statistics*, Washington D.C., 1988.

نموذج كلي قياسي للاقتصاد السعودي: ١٩٧٠–١٩٨٥م

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المستخلص: شهد الاقتصاد السعودي في السنوات القليلة الماضية تطورًا هائلا في معدلات نمـو القطاعات الاقتصادية المختلفة. وقد كان الإنفاق الحكومي المتزايد السبب الرئيس في الوصـول إلى هذا المستوى المرتفع من التقدم والنمو.

تهـدف هـذه الدراسـة إلى تفسـير وشـرح بعـض العلاقـات الداليـة الهامـة في الاقتصـاد السعودي، وذلك بتقـدير بعـض المؤشـرات الاقتصادية الكليـة مثـل الاستهلاك، الاستثمار، الواردات والطلب على النقود.

وباستخدام طريقة المربعات الصغرى (Ordinary Least Squares) وبعـد تصـحيح مشـكلة الترابط الخطي، تبين أن الإنفـاق الحكـومي مـن أهـم العوامـل المحـددة للمؤشـرات الاقتصـادية الكلية، وهذا ليس بغريب على الاقتصاد السعودي حيث إن الدولة قامت بإنفاق ما يزيد على ٢ تريليون ريال سعودي على عمليات التنمية خلال العشرين سنة الماضية.

كذلك تبين أن سعر الفائدة ليس له تأثير يذكر على المؤشرات الاقتصادية الكليـة، وقـد يرجـع ذلـك إلى وجـود أنـواع أخـرى مـن الاسـتثمارات ذات العائـد الأعلـى مثـل عوائـد الاسـتثمارات العقارية، عوائد الأسهم المضمونة من قبل الحكومـة، عوائـد المضـاربة في أسـعار الـذهب والعمـلات الرئيسة الحرة، بالإضافة إلى طبيعة الاقتصاد السعودي وتميزه بالتمسك بالتعاليم الإسـلامية الـتي تحـرم التعامل بالفائدة وعدم توافر الأسواق المالية الحديثة إلا منذ عهد قريب.

وقـد قـدرت الدراسـة معامـل المضـاعف في الاقتصـاد السـعودي بحـوالي ٢,٥ وسـرعة التداول للنقود بحوالي ٣ مرات.