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FINANCIAL INFLUENCES ON THE BEHAVIOR  
OF OIL EXPORTERS

BY

Mansoor Dailami

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I. INTRODUCTION

This paper discusses the influence of financial considerations on the oil production policies of oil producing countries. Financial considerations are only one set in an array of factors affecting the decisions of these countries. Other factors include technology, politics, and conservation.<sup>1</sup> This study, therefore, should be viewed as only a partial analysis of oil supply determination. However, it has become increasingly clear that the decisions of the oil producing countries may be more heavily influenced by short-run financial considerations, such as their need for foreign exchange, their assessment

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<sup>1</sup>For an interesting discussion of how political considerations may influence oil production decisions of these countries; see Noreng (1978) and Weisberg (1977) and for other studies on financial considerations see Ben-Shahar (1976) and Moran (1978).

of the availability and cost of foreign financing, and their apprehension of the impact of changes in oil revenues on their domestic economies, than by any long-run consideration.

One important factor bearing upon this issue is the predominance of the oil sector in their national economies. Exhibits A.1 and A.2 in the appendix indicate the degree to which the economy of these countries depends on oil revenues. These exhibits show the ratio of oil exports to total exports and the ratio of oil revenues to total government revenues for a selected number of oil producing countries for different years. These exhibits demonstrate that oil exports accounted for more than 90 percent of total exports in Algeria, Iran, Iraq, Kuwait, Libya, and Saudi Arabia in 1977. However, the contribution of oil exports to total exports is less significant in Indonesia and Mexico (about 67 percent in Indonesia and about 22 percent in Mexico in 1977). Similarly, oil revenues constituted the major source of government revenues in these countries. On the average, oil revenues provided about 78 percent of total government revenues in 1977. Changes in oil revenues have an immediate impact on the balance of payments, government budget, money and credit supply, prospects of economic growth, and thus on social and economic stability. Hence, these countries are increasingly conscious of the problems inherent in using their oil resources, and the allocation of their oil earnings among various uses.

In keeping with our emphasis on the short-run behavior of oil exporters, this analysis is based on a "warehouse model" approximation of the oil supply process of these countries. That is, the oil supply process is treated as if oil were stored in a warehouse. The detailed

processes of oil exploration, development, production, and refining (of products) are neglected in the analysis,<sup>2</sup> and it is assumed that an oil exporting country can produce and export its desired amount with no binding technological and productive capacity constraints. This is a simplifying assumption that will be amended in future research. However, it might be possible to justify this assumption for the group of oil exporters whose existing productive capacity greatly exceeds their production,<sup>3</sup> and thus increasing their production up to the capacity limit may not take much time, nor require much substantial investment in oil exploration and development.

In analyzing how financial considerations influence the behavior of oil exporting countries, it is useful to distinguish between two groups: the financial surplus and the financial deficit countries. Judging from their current account on the balance of payments in 1977, the first group includes Iran, Iraq, Kuwait, Libya, and Saudi Arabia; the second group includes Algeria, Indonesia, Nigeria, and Venezuela. This distinction is not steadfast, as the trade position of any country may change either as a result of that country's change in its trade and economic policies or as a result of developments in the world price of oil. Indeed, it is interesting to analyze the circumstances in which a given oil exporter

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<sup>2</sup>For studies on oil supply determination taking into account the oil production process in detail, see Adelman and Jacoby (1977), Adelman and Paddock (1979) and Eckbo, Jacoby and Smith (1978).

<sup>3</sup>The excess capacity of OPEC in March 1979 was estimated to be 4,350 thousand barrels per day, excluding Iran and 8,990 thousand barrels per day including Iran. Other countries with large excess capacity were: Saudi Arabia (1,066), Kuwait (1,053), UAE (-677), and Iraq (700). For more discussion of OPEC's excess capacity, see Jacoby and Paddock (1979).

would change from one group to the other. For instance, a deficit country may move to the surplus group by restricting its imports and/or expanding its exports of oil and other commodities, and vice versa.

This distinction is significant when judging the relative influence of these two groups of countries in determining the price of oil. It is assumed that the surplus countries -- of which Saudi Arabia is the most important -- play a dominant role in setting the price of oil.<sup>4</sup> Accordingly, the deficit countries are treated as price takers in the sense that each country takes the world price as given and plans its oil supply in accordance with its own national interests, without considering the implications of that level of oil supply on the world price of oil. This treatment has the desirable analytical advantage of simplifying our financial analysis.

The paper is divided into three sections. Section 1 discusses the influence of financial factors on the oil production decisions of one deficit country, Venezuela. The discussion uses a macro-financial model constructed to capture the important characteristics of Venezuela's economy. This model analyzes how changes in oil revenues affect such important economic variables as the rate of economic growth, money supply, governmental deficit or surplus, balance of payments, and the amount of foreign borrowing or lending. This analysis then derives the amount of oil supplied, given the government's overall economic objectives with regard to growth and external financial position. The model is designed to be particularly suitable for simulation purposes.

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<sup>4</sup>In most of the studies about OPEC, this has generally been accepted as a working assumption; see for example, Adelman and Jacoby (1977).

It allows one to analyze the implications of alternative financing options, such as foreign borrowing, on the oil supply decisions of the oil exporters. Given the option of foreign borrowing, the oil supply decisions of these countries will be directly affected by how they exercise this option. To the extent that these countries may resort to foreign borrowing instead of seeking higher oil revenues from increased oil production, their oil supply decisions will be shaped to a large extent by both the availability and cost of foreign borrowing and the expected price of oil. If oil under the ground is expected to appreciate by more than the compensation for the cost of foreign borrowing, then it may be more profitable to hold back production and borrow abroad. For this reason the option of foreign borrowing has been explicitly incorporated in the model.

Section 2 analyzes how financial considerations influences oil supply decisions of one surplus country, Saudi Arabia. Hypotheses about the likely behavior of this country in utilizing its foreign financial assets, as an alternative to the export of oil in financing its imports, are developed, and on the basis of these hypotheses, the oil supply schedules for this country, until 1985, are derived. These calculations are performed using different scenarios of the real price of oil and different levels of imports.

Section 3 presents some important conclusions.

## 2. DEFICIT COUNTRIES: THE CASE OF VENEZUELA

This section has two objectives: (a) to analyze the effect of changes in oil exports on the domestic economy of Venezuela; and (b) to derive some likely oil export requirements for this country, given the world oil price and the government's overall economic objectives with regard to growth and monetary stability. These objectives are pursued, in turn, in subsections 2.1 and 2.2.

### 2.1 The Impact of Changes in Oil Revenues on the Domestic Economy

In analyzing the effect of changes in oil revenues on the economy of Venezuela, we have used a macro-financial model constructed for this country. The model is essentially a Keynesian type macro-model which has been modified to capture some of the important characteristics of an oil exporting country. An important distinguishing characteristic of these countries' economies is the fact that a substantial portion of their export earnings, namely oil revenues, accrue directly to the government. Thus, changes in oil revenues have monetary implications for both the government's budget and the balance of payments. In other words, the government's budget and the balance of payments in these countries are highly interdependent.<sup>5</sup> For instance, any improvement in the balance of payments, brought about as a result of increased oil revenues, is simultaneously accompanied by an improvement in the government's budget.

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<sup>5</sup>For a detailed discussion of this distinguishing feature of oil exporters, and its implications for domestic money and credit creation, see Dailami (1978), and Morgan (1979).

The macro-financial model used in this study is designed to explicitly capture the interaction in the government and external sectors, as well as make provisions for analyzing the influence of alternative financing options (such as foreign and domestic borrowing) on the oil supply decision of the government. A presentation of the model with the estimation results for Venezuela is presented in Appendix A. A more detailed description and discussion of this model will be available in a forthcoming working paper.

This section is confined to the discussion of some of the simulation results of the model. Given an anticipated oil revenue trajectory, the model computes the resulting GDP, money supply, government deficit and government foreign debt, as well as other macroeconomic variables, over the study period. Table (1) presents the simulation results for these variables through 1985, on the basis of two oil revenue increase scenarios: 12.5 and 17.5 percent annual increases.<sup>6</sup> All results presented in Table 1 are in nominal terms. With the amount of oil revenue increasing at 12.5 percent per year, GDP increases from an actual value of 156.1 billion bolivares in 1977 to a simulated value of 361.5 billion bolivares in 1985. Over the 1978-1985 simulation period, GDP increases at a steady rate of about 10 percent per year in nominal terms, which is less than the rate of growth observed during the 1976-1977 period. The government budget will be mostly in deficit during the

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<sup>6</sup>Any increase in the amount of oil revenues can be interpreted either as a result of changes in oil exports or as a result of changes in oil prices. For this part of our simulation, the source of change does not matter. But to be consistent with the arguments in the rest of the paper we interpret the changes in oil revenues as a result of changes in the price of oil.



simulation period, but not at a scale that would create financing problems. The projected government deficit increases from a value of 3.19 bolivares in 1978 to 3.79 in 1981, and then declines gradually to 2.47 billion bolivares in 1985. The foreign debt of the public sector increases at an annual rate that is more or less sufficient to finance the government deficit. From an actual value of 17.55 billion bolivares in 1977, the government's stock of foreign debt increases to 40.19 billion bolivares in 1985. This increase reflects the debt service payments as well as the net foreign borrowing.

In the case where oil revenues increase by 17.5 percent per year, the result is a higher rate of economic growth, a higher increase in the money supply and a higher accumulation of foreign debt. In this case, GDP will increase at a steady rate of about 13 percent per year (nominal), over the simulation period. According to this higher oil revenue increase scenario, the government will, in fact, be compelled to borrow more heavily abroad. In this case, its stock of foreign debt will reach a level of 46.55 billion bolivares in 1985. As compared to the corresponding figure in the previous case, this indicates an increase of about 6.36 billion bolivares in the stock of foreign debt in 1985.

## 2.2 The Projected Oil Export Requirements

Given the dominant role of oil revenues in the government's budgetary accounts and in the balance of payments, and hence in the pace of economic growth, the question arises as to how export policies should be designed to insure economic growth and financial and monetary stability. In particular, if a certain rate of economic growth is targeted, and if oil export policies are geared to achieving this

Table 1

ECONOMIC PROFILE OF VENEZUELA 1976-1985

(Figures in Billions of Current Bolivares)

	Actual					Simulated				
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Oil revenues Increase in 12.5 Percent	37.59	39.10	43.99	49.49	55.68	62.64	70.47	79.27	89.18	100.33
	135.4	156.1	177.7	200.9	224.0	247.9	273.2	300.3	329.6	361.5
	30.39	38.48	47.54	57.72	66.78	75.17	83.18	90.95	98.54	105.88
	2.40	10.90	3.19	3.52	3.72	3.79	3.73	3.53	3.13	2.47
	11.16	17.53	21.18	25.07	28.47	31.52	34.25	36.66	38.69	40.19
Oil revenues Increase in 17.5 Percent	37.59	39.10	45.94	53.99	63.43	74.54	87.58	102.91	120.92	142.08
	135.4	156.1	182.8	213.0	244.9	279.7	318.3	361.4	409.8	464.3
	30.34	38.48	48.35	59.91	70.74	81.13	91.16	100.75	109.59	117.19
	2.40	10.9	3.52	4.18	4.67	4.96	4.99	4.67	3.81	2.17
	11.16	17.53	21.61	26.24	30.65	34.87	38.81	42.31	45.05	46.55

Notes:

For exact definition of variables, see the description of the model in Appendix A.

objective, then what is the required level of oil exports? In answering this question for Venezuela, the macro-financial model is used in this section to generate simulated oil export requirements assuming different target rates of economic growth and different oil price increase scenarios. Specifically, three alternative economic growth scenarios of varying degrees of robustness are attempted: 10%, 15%, and 20% annual growth in nominal GDP.<sup>7</sup> These simulations are each run under three nominal oil price increase scenarios: 12.5%, 14.5%, and 17.5%<sup>8</sup> annual growth rates through 1985.

Table (2) presents our model's projections of Venezuela's average daily oil export requirements to 1985, on the basis of the above oil price and economic growth scenarios. As this Table indicates, the simulated oil export requirements are highly dependent on the assumptions made with regard to the future behavior of the price of oil and the rate of economic growth. This is particularly true for the later years of the sample period. For instance, in 1985, with the price of oil increasing at an annual rate of 17.5 percent until then, the simulated oil export requirements vary from 1.26 to 3.27 million barrels per day, depending on

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<sup>7</sup>Ideally, the real rate of growth of GDP should be used in this simulation exercise. But since the model, at its present stage, does not explain inflationary pressure in the economy, we were forced to use nominal GDP growth rate. This presents the problem of not knowing whether a certain growth rate in GDP is due to inflation or due to actual growth in the economy. Research is under way to improve the model in this direction.

<sup>8</sup>The reason for choosing these particular values for oil price increases is explored in detail in Section 3. Basically, these oil price increase scenarios are considered from the viewpoint of Saudi Arabia. Specifically, these figures are calculated to insure Saudi Arabia's terms of trade to stay constant, to grow at 2 or 5 percent per year through 1985, if Saudi Arabia's import price index increases at its historical rate of 12.5 percent per year (the 1972-1978 average).

Table 2

THE PROJECTED DAILY OIL EXPORTS FOR VENEZUELA (MILLION BARRELS)

YEAR	12.5 Percent Increase in Price of Oil *			14.5 Percent Increase in Price of Oil			17.5 Percent Increase in Price of Oil		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
1978	1.89	2.02	2.16	1.86	1.99	2.12	1.81	1.94	2.07
1979	1.81	2.08	2.35	1.75	2.00	2.27	1.66	1.90	2.16
1980	1.78	2.17	2.61	1.69	2.06	2.48	1.56	1.91	2.29
1981	1.77	2.30	2.91	1.65	2.14	2.72	1.49	1.93	2.45
1982	1.77	2.44	3.26	1.62	2.23	2.99	1.42	1.96	2.63
1983	1.77	2.59	3.66	1.60	2.33	3.29	1.37	1.99	2.82
1984	1.78	2.76	4.11	1.57	2.44	3.63	1.31	2.03	3.03
1985	1.79	2.94	4.63	1.55	2.55	4.02	1.26	2.07	3.27

Notes

- (a) 10 percent annual growth in nominal GDP
- (b) 15 percent annual growth in nominal GDP
- (c) 20 percent annual growth in nominal GDP

\* The oil price series are calculated from the base price of \$12.5 per barrel in 1977. This figure has been derived by dividing the oil revenues in 1977 (\$6.1 billion) by the export in that year (1.9 mb).  
Source: Petroleum Economist, June 1979

whether the economy grows at 10 percent or 20 percent per year from 1978 to 1985. Similarly, changes in the anticipated price of oil influence the supply of oil, but not so much as changes in the rate of economic growth affect oil supply. For instance, in 1985, with GDP growing at 15 percent per year, the simulated oil export requirements vary from 2.94 to 2.07 million barrels per day, depending on whether price grows at 12.5 percent or 17.5 percent per year from 1978 to 1985. In other words, the simulated oil export requirements exhibit more sensitivity to changes in the rate of economic growth than to price changes. Thus, in the next few years, the oil export policy of Venezuela seems to be more strongly influenced by internal economic needs for financial resources than by movements in the price of oil.

As may also be observed from Table 2, the oil export requirements of Venezuela in the mid-1980s, as implied by the outcome of most of the scenarios considered here, will exceed its present oil production capacity. Maintaining the existing oil production capacity of 2.2 to 2.4 million barrels a day,<sup>9</sup> and a projected internal oil consumption of about 550 thousand barrels per day in 1985,<sup>10</sup> it is only possible for

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<sup>9</sup>2.4 refers to maximum sustainable capacity of Venezuela; that is, it is the maximum, production rate that can be sustained for several months; and 2.2 refers to available or allowable capacity. It reflects production ceilings usually applied to annual average output. See, Euromoney, July 1979, for this.

<sup>10</sup>This figure represents a very rough approximation to Venezuela's consumption of refined petroleum products. It is estimated using the assumption that Venezuela's consumption of refined petroleum products will increase through 1985 at its historical annual rate of 8.46 percent - average over 1972-1977 period - (source of data: OPEC Annual Statistical Bulletin 1977). The consumption of refined petroleum products has historically been less than total domestic oil used (the difference between oil production and oil exports) due to use of oil in the oil fields and in the refineries, and this discrepancy in some years has been very significant, see Aljanabi (1979) for this. Thus, the total amount of oil used in 1985 is likely to exceed the projected value of 550 thousand barrels a day.

Venezuela to accommodate a growth rate of up to 10 percent per year in nominal GDP through 1985, so long as the growth rate of the price of oil lies within the range of 12.5 to 17.5 percent per year. However, any policy that may envisage a growth rate greater than 10 percent per year (for that oil price range) will likely be constrained by oil production capacity and, thus, its implementation will require expansion of the existing oil production capacity. The urgency for expansion of the oil capacity will, in fact, be greater if the annual rate of growth in the price of oil falls below 12.5 percent during the 1978-1985 period. However, for the immediate future (from one to two years), there does not appear to be any pressing need for expansion of the existing oil production capacity, even if the economy is expected to grow beyond 10 percent per year.

Concentrating on the immediate future, say 1980 or 1981, it is possible to derive some likely oil export forecasts for Venezuela. In achieving this objective it is important to take into account the recent price increases administered by OPEC in late 1978 and in 1979. In view of these recent oil price adjustments, the actual price of oil in 1980 or 1981 is likely to be close to the outcome of our high-oil-increase scenario; that is, oil price increases of 17.5 percent per year. Thus, according to this scenario, the oil exports of Venezuela will be between 1.56 to 1.91 million barrels a day in 1980 and between 1.49 to 1.93 million barrels in 1981 if the economy grows at a rate of between 10 to 15 percent per year in the interim period.

### 3. SURPLUS COUNTRIES: THE CASE OF SAUDI ARABIA

#### 3.1 Oil Production Requirements

This section focuses on the financial surplus oil-producing countries, particularly Saudi Arabia. The vital role that Saudi Arabia could play in balancing the net world demand for petroleum and in maintaining and securing stability in the price of oil is well recognized.<sup>11</sup> The combination of several factors has given this country the ability to exercise a dominant influence on the pace of OPEC's oil supply, and thereby on the price of oil. These factors include Saudi Arabia's large oil reserves, its relatively small population, its existing large productive capacity and oil exports, and its substantial financial assets. Saudi Arabia has the world's largest oil reserves and currently is the largest oil exporter. According to experts' estimates, its production profile could easily stretch to 2025 and years beyond. Based on "possible" reserves of 225 to 245 billion barrels, this country can maintain a production level of up to 8 mmbd in 2025, with an interim sustainable production plateau of 12 million barrels per day for 36 years.<sup>12</sup> In terms of financial assets, Saudi Arabia has the largest accumulation of foreign assets among OPEC countries. During the period 1974-1978, its cumulative current account,

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<sup>11</sup>For analysis of Saudi Arabia's role as the residual oil supplier see General Accounting Office, report to the U.S. Congress (1978), The United States Senate, a staff report to the Subcommittee on International Economic Policy (1979), Noreng (1978), and Jacoby and Paddock (1979).

<sup>12</sup>This is on the basis of a staff report to a subcommittee to the U.S. Senate Committee on Foreign Relations, April 1979.

on the balance of payments, amounted to \$83 billion. This raised the Saudi Arabians' net external assets to \$73 billion at the end of 1978.<sup>13</sup>

Given these financial and mineral resources, Saudi Arabia clearly has a great deal of flexibility in monitoring its oil production policies to pursue other objectives in addition to internal revenue needs. From the viewpoint of foreign exchange requirements, it seems possible for Saudi Arabia to accommodate moderate increases in its level of imports in the immediate future, and at the same time, to cut its production to much lower levels. Table (3) presents some rough calculations of the future average daily oil production necessary for Saudi Arabia to balance its yearly current account through 1985.<sup>14</sup> These calculations are performed using different scenarios of the real price of oil and different levels of imports. Also incorporated in these calculations is the assumption that Saudi Arabia will not draw on its foreign financial assets. However, interest receipts on foreign assets - net of grants and aid to other countries - will continue to be an additional source of income.

Considering the oil production "requirements" of Saudi Arabia in the next few years, it is interesting to observe that our simulation model implies levels of oil production that fall below the current oil production. For instance, the "required" daily oil production for 1980 appears to be 5.63, 5.32, and 4.90 million barrels if the real price of

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<sup>13</sup>See Morgan Guaranty Trust, World financial Markets, May 1979.

<sup>14</sup>These calculations are performed using a simple model constructed for Saudi Arabia. For discussion of the model and the assumptions made in generating the simulation results, see Appendix B.



TABLE 3

THE REQUIRED AVERAGE DAILY OIL PRODUCTION\* FOR SAUDI ARABIA (MILLION BARRELS)

YEAR	REAL PRICE OF OIL** CONSTANT		2 PERCENT INCREASE IN REAL PRICE OF OIL		5 PERCENT INCREASE IN REAL PRICE OF OIL				
	Price of Oil (a)	(b)	Price of Oil (a)	(b)	Price of Oil (a)	(b)			
1978	14.9	3.27	3.42	15.2	3.21	3.35	15.7	3.12	3.26
1979	16.8	4.34	4.72	17.5	4.18	4.55	18.6	3.96	4.35
1980	18.9	5.63	6.37	20.1	5.22	6.10	21.9	4.90	5.62
1981	21.3	7.24	8.49	23.1	6.72	7.95	25.9	6.03	7.05
1982	24.0	9.22	11.21	26.5	8.39	10.20	30.6	7.32	8.88
1983	27.0	11.67	14.72	30.4	10.43	13.14	36.2	8.85	11.13
1984	30.4	14.72	19.26	34.9	12.90	16.86	42.7	10.66	13.89
1985	34.2	18.52	25.14	40.0	15.93	21.58	50.5	12.81	17.29

NOTES

\* Includes domestic consumption as well. Domestic consumption is assumed to increase at its historical rate of 23 percent per year (average over 1971-1977). Source: OPEC Review, March 1979.

\*\* The nominal price of oil is expected to increase 12.5 percent per year. For reasons behind this assumption, see note (1)

(a) Import volume increases 25 percent per year.

(b) Import volume increases 30 percent per year.

oil<sup>15</sup> stays constant, grows at 2 percent per year, and grows at 5 percent per year, respectively, and if import volume increases at 25 percent per annum. Increasing the annual growth rate of import volume to 30 percent, the required oil production levels corresponding to the three oil price scenarios above rise to 6.37, 6.1, and 5.62 million barrels per day. This conclusion seems to hold until 1982, when simulated oil production requirements begin to exceed the current level with accelerating speed.

Also interesting is the observation that the simulated oil production requirements are highly dependent on the assumptions made with regard to the growth of imports and with the future behavior of the real price of oil. This dependency is especially more pronounced for the later years of the sample period. For instance, in 1985, with the real price of oil staying constant, the simulation result imply a required daily oil production of 18.52 million barrels per day if import volume grows at 25 percent per year, and a production level of 25.14 million barrels per day if imports grow at 30 percent per year. These figures, however, are considerably reduced to 12.81 and 17.29 if it is assumed

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<sup>15</sup>The real price of oil,  $Pr$ , is defined as  $Pr = Po/Pm$ , where  $Po$  is the nominal price of oil in terms of U.S. dollar and  $Pm$  is Saudi Arabia's import price index. Saudi Arabia's import price index was estimated over the period 1972-1978 as the weighted average of the export price indices of nine major industrial countries (the U.S., the U.K., Japan, Germany, France, Belgium, Italy, Switzerland and the Netherlands), all expressed in dollar terms. The weights used were Saudi Arabia's import shares from these countries. See Dailami (1979a) and (1979b) for a detailed discussion of this. This procedure resulted in an annual rate of growth of about 12.5 percent per year for Saudi Arabia's import price index (the 1972-1978 average). Assuming that this trend continues in the future, the nominal price of oil should increase at 12.5 percent per year to insure the real price of oil, viewed from Saudi Arabia's viewpoint, to stay constant.

that the real price of oil increases by 5 percent per year. But, even with this high-oil-price-increase scenario, the projected oil production requirements for 1985 appear to be improbably high and they exceed the present oil production capacity of Saudi Arabia.<sup>16</sup> Then to what extent Saudi Arabia may expand its oil production capacity to accommodate these projected oil production requirements depends to a large extent on its emphasis on continuing a policy of import-intensive economic growth, and to some extent, on the future price of oil. Judging from the recent experience of Saudi Arabia, an assumed rate of growth of 30 percent per year in the volume of imports is in fact an underestimation of the actual rate. During the period 1974-1978 Saudi Arabia's imports increased 40 percent per year in real terms.<sup>17</sup> This made Saudi Arabia the largest OPEC importer in 1978. To what extent this high rate of import growth will be sustained in the future is conjecture. Much depends on the ease with which Saudi Arabia can curtail its imports, by either promoting domestic production or slowing economic growth. However, in the short run - say two to three years - the scope of implementing an effective import-substitution policy seems limited. This leaves slowing economic growth as the only viable option.

According to the 5 percent real-oil-price-increase scenario and starting with the base price of \$13.33 per barrel in 1977,<sup>18</sup> the

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<sup>16</sup>See note 3.

<sup>17</sup>See Morgan Guaranty, World Financial Markets, May 1979, p. 2.

<sup>18</sup>This is the average price of Arabian Light, F.O.B. Ras Tanura, 34.00 - 34.09, in 1977. The average is taken over two observations: \$13 in January 1, and \$13.66 in July 1, 1977. Source of data: OPEC Annual Statistical Bulletin, 1977, p. 130.

nominal price of oil will be about \$50.50 per barrel in 1985. This figure reflects an assumed rate of increase of 12.5 percent per year in the price of oil to compensate for the effects of inflation and exchange rate changes in addition to the 5 percent increase in the real price. Implicit in this calculation is the assumption that Saudi Arabia's import price index will increase at its historical rate of 12.5 percent (the 1972-1978 average), through 1985. Also implicit in this calculation is the assumption that OPEC can protect its export earnings by keeping constant the real price of oil. From OPEC's point of view, this will essentially involve adopting an oil pricing mechanism that would reduce or eliminate the risk of exchange rate changes as well as gradually adjusting the nominal price of oil in proportion to the rate of inflation in the industrial countries.<sup>19</sup> In the past, specifically the period 1974-1978, the real price of oil exhibited a trend of continuous decline. However, this trend has probably been reversed by the series of oil price increases administered in late 1978 and in 1979. This has resulted in a price of oil in 1979 for Saudi Arabia that is very close to the outcome of our 5 percent real-oil-price increase scenario. However, it remains to be seen how accurately this scenario will predict the actual price of oil for years beyond 1979.

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<sup>19</sup>For a detailed study of how OPEC can protect its export earnings from exchange rate losses, see Dailami (1978b).

### 3.2 The Option of Building Up Foreign Assets

An additional option open to Saudi Arabia is to continue its oil production at the current level for the next few years in order to build up its foreign assets, which can be drawn on in later years. The interest earned on these assets can provide an additional source of income to lessen the pressure on the oil sector. However, the extent to which interest earnings can substitute oil exports as a source of financing imports in any specific year depends on the level of imports in that year, on the quantity of oil exported in the preceding years, and on the behavior of the real price of oil. Table (4) presents the outcome of a simulation exercise undertaken to show the effectiveness of this policy option. This exercise uses several different assumptions regarding the growth of imports and the future price of oil. For instance, with import volume growing at 25 percent per year, and with a constant real price of oil, the proportion of imports that can be financed by interest earnings in 1980 is about 32 percent if Saudi Arabia's oil export is maintained at 9 million barrels per day in 1979. Changing the rate of growth of import volume to 30 percent per year, the corresponding figure declined to 28 percent. In any case, these results indicate that Saudi Arabia can cut its oil exports by an amount equivalent to one-third of its imports in 1980, by merely relying on its interest earnings in that year.

However, the proportion of total imports that can be financed by interest declines sharply towards the middle of the 1980's. Even under the most optimistic scenario considered here - rate of growth of import volume of 25 percent per year and a 5 percent increase in the real price of oil - only about 12 percent of total imports can be financed in 1985

by relying on interest earnings in that year if oil exports are maintained at 9 million barrels per day through 1984. In the event that import volume increases 30 percent per year and the real price of oil stays constant through 1985, the proportion of imports that can be financed by interest earnings in 1985 declines sharply to less than one percent. This decline clearly reflects that an oil export policy of 9 million barrels per day is insufficient to finance Saudi Arabia's imports in the mid-1980s. Consequently, Saudi Arabia will be increasingly compelled to draw on its stock of foreign financial assets to finance its imports. The need to draw on foreign assets will be greater if import volume grows at rates exceeding 25 percent per year and if the real price of oil does not increase during the 1978-1985 period.

TABLE 4

THE PROPORTION OF IMPORTS FINANCED BY INTEREST INCOME

(1978-1985)

YEAR	<u>CONSTANT REAL PRICE OF OIL</u>		<u>2 PERCENT INCREASE IN REAL PRICE OF OIL</u>		<u>5 PERCENT INCREASE IN REAL PRICE OF OIL</u>	
	<u>(a)</u>	<u>(b)</u>	<u>(a)</u>	<u>(b)</u>	<u>(a)</u>	<u>(b)</u>
1978	.33	.32	.33	.32	.33	.32
1979	.33	.31	.34	.31	.34	.31
1980	.32	.28	.33	.28	.34	.29
1981	.28	.23	.29	.24	.31	.25
1982	.23	.17	.25	.18	.27	.20
1983	.18	.11	.20	.13	.23	.15
1984	.12	.15	.14	.07	.18	.10
1985	.06	.007	.09	.02	.12	.05

## Notes:

(a) Import volume grows at 25 percent/year

(b) Import volume grows at 30 percent/year

#### 4. CONCLUSION

This paper discussed how short-term financial considerations may influence the oil production policies of oil exporting countries, and concentrated on two countries: Venezuela and Saudi Arabia. In the case of Venezuela, a macro-financial model was constructed to analyze the effect of changes in oil revenues on GDP, money supply, government deficit, and government foreign debt. In this regard it was found that increases in the oil revenues will have a positive effect on all these variables. For instance, an incremental increase of 5 percent in oil revenues from 12.5 to 17.5 percent per year will raise the average annual rate of growth of GDP from 10 percent to 13 percent during the simulation period, i.e., 1978-1985. The model was then used to forecast likely oil exports of Venezuela. Different oil price and economic growth scenarios were used in forecasting oil exports. In view of the recent OPEC oil price adjustments, we decided to rely on the outcome of the high-oil-price-increase scenario as the most accurate prediction of the actual price of oil in 1980 and 1981. In this case, the oil exports of Venezuela were forecast to be between 1.56 and 1.91 million barrels per day in 1980, and between 1.49 and 1.93 million barrels per day in 1981, if the economy were to grow at a rate between 10 and 15 percent per year during the interim period.

In the case of Saudi Arabia, our analysis was conducted with a more simplified model. By concentrating on the external sector of Saudi Arabia's economy, the average daily oil production requirements for this country were derived using different scenarios of the real-price of oil and different levels of imports. It was generally found that Saudi



Arabia could cut its oil production, in 1980, by about 1/3 of its current production and still plan for import volume growth of up to 30 percent per year in 1979. However, it will not be feasible to continue this policy of import growth to the mid-1980's, even at a steady oil production level of 9 million barrels per day. In fact, in 1985 Saudi Arabia's oil production requirements for import growth rates of even 25 percent per year in real terms would most likely be constrained by productive capacity limitations.

Thus, in the early years of the 1980's, Saudi Arabia will probably be compelled, due to both financial and productive capacity limitations, to cut its import growth rate to below 25 percent per year in real terms.

Appendix AA.1. The ModelGovernment Sector

1.  $\text{Log}(\text{GPUR}) = g_0 + g_1 \cdot \text{Log}(\text{XP})$
2.  $\text{Log}(\text{GREVNET}) = n_0 + n_1 \cdot \text{Log}(\text{GDP}) + n_2 \cdot \text{Log}(\text{GREVNET}(-1))$
3.  $\text{Log}(\text{GREVP}) = f_0 + f_1 \cdot \text{Log}(\text{XP})$
4.  $D = \text{GPUR} + \text{GEXPINT} + \text{GEXPAM} - \text{GREVNET} - \text{GREVP}$
5.  $\text{GEXPINT} = r \cdot B(-1)$
6.  $B = B(-1) + (1-\lambda) \cdot D + (1-\gamma) \cdot \text{DIR}$
7.  $\text{BF} = \beta \cdot B$
8.  $\text{GEXPAM} = \mu \cdot B(-1)$

Foreign and Monetary Sector

9.  $\text{Log}(\text{IMP}) = m_0 + m_1 \cdot \text{Log}(\text{GDP})$
10.  $\text{DIR} = \text{XNP} + \text{XP} - \text{IMP} + B - (1+r) \cdot B(-1) + \text{PKF}$
11.  $\text{MOR} = \text{MOR}(-1) + \lambda \cdot D + \gamma \cdot \text{DIR} + \Delta \text{BC}$

Private Sector

12.  $\text{Log}(A) = a_0 + a_1 \cdot \text{Log}(\text{GDP}) + a_2 \cdot \text{Log}(\text{MOR})$
13.  $\text{GDP} = A + \text{XNP} + \text{XP} + \text{GPUR} - \text{IMP}$

Oil Sector

14.  $\text{PRODOIL} = \text{XP}/(\text{POIL} \cdot \text{XRATE} \cdot 365)$

Notationa. Policy Variables (Parameters)

- $\lambda$  The proportion of total government deficit financed by the central bank.
- $\gamma$  The proportion of increases in international reserves which becomes part of the monetary base.
- $\beta$  The proportion of the government debt held by foreigners.
- $\mu$  The proportion of government debt amortized each year.
- XRATE Exchange Rate Boivares/U.S.\$

b. Exogenous Variables

- GDP Gross Domestic Product at current market prices.
- POIL Price of oil U.S.\$/barrel
- XNP Exports of non-petroleum products
- PKF Private Foreign Capital Inflow (net)
- BC Central banks net credit to commercial banks.

c. Endogenous Variables

- GPUR Government expenditures on goods and services
- GREVNET Non petroleum government revenues, net of transfers (excluding interest) made to the private sector.
- GREVP Government revenues from petroleum.
- GEXPINT Government interest payments on its debt
- D Government deficit
- B Total government debt
- BF Government foreign debt.
- GEXPAM Government expenditure on amortization of its debt

IMP Imports of goods and services  
XP Exports of oil and gas  
DIR Change in international reserves  
A Total private expenditure  
PRODOIL Production of oil--millions of barrels per day  
MOR Monetary base

## A.2 Estimation Results

We estimated equations (1), (2), (3), (9) and (12) using O.L.S. over the period 1962-1977. The results were as follows:

### Equation (1)

<u>parameter</u>	<u>value</u>	<u>t-statistic</u>
$g_0$	-2.00	3.09
$g_1$	1.20	17.77
$\bar{R}^2 = .954$	D.W. = 1.25	

### Equation (2)

<u>parameter</u>	<u>value</u>	<u>t-statistic</u>
$n_0$	-1.85	2.74
$n_1$	0.54	3.02
$n_2$	0.53	2.80
$\bar{R}^2 = .957$	D.W. = 2.25	

### Equation (3)

<u>parameter</u>	<u>value</u>	<u>t-statistic</u>
$f_0$	-3.59	11.20
$f_1$	1.32	39.56
$\bar{R}^2 = .991$	D.W. = 1.65	

### Equation (9)

<u>parameter</u>	<u>value</u>	<u>t-statistic</u>
$m_0$	-4.32	4.91
$m_1$	1.25	15.60
$\bar{R}^2 = .942$	D.W. = 1.18	

Equation (12)

<u>parameter</u>	<u>value</u>	<u>t-statistic</u>
$a_0$	3.08	2.67
$a_1$	0.33	1.28
$a_2$	0.46	2.25
$\bar{R}^2 = .965$	D.W. = 1.00	

In the simulation exercises the following values were chosen for the policy variables:

$$\lambda = .29, \quad \gamma = .5, \quad \beta = .7, \quad \mu = .1, \quad \text{XRATE} = 4.29$$

A.3 Data

The data were compiled mainly from two sources: International Monetary Fund, International Financial Statistics, various issues, and Banco Central de Venezuela, Informe Economico, various issues, Caracas Venezuela.

A SIMPLE MODEL OF OIL EXPORT AND  
FOREIGN CAPITAL ACCUMULATION FOR  
SAUDI ARABIA

B.1 The Model

$$A_t = A_{t-1} + S_t$$

$$S_t = X_t + r \cdot A_{t-1} - G_t - Vm_t$$

$$Q_t = Qm_{t-1} (1 + g_m)$$

$$Poil_t = Poil_{t-1} (1 + gp_o)$$

$$Pm_t = Pm_{t-1} (1 + gp_m)$$

$$Vm_t = Qm_t \cdot Pm_t$$

$$Q_t = (X_t \cdot 1000) / (Poil_t \cdot 365) + Dc_t$$

$$Dc_t = Dc_{t-1} (1 + g_{dc})$$

B.2 Notation

$A_t$  Net external assets at the end of year t in billions of U.S. dollars

$S_t$  Current account surplus in billions of U.S. dollars

$X_t$  Oil revenue in billions of U.S. dollars

$Qm_t$  Quantity of Imports

$Pm_t$  Price of imports in terms of U.S. dollars

$Poil_t$  Price of oil (US \$ per barrel)

$Q_t$  Daily oil production (million barrels)

$Dc_t$  Domestic Consumption (million barrels)

$g_m$  Annual rate of growth in quantity of imports

$gp_o$  Annual rate of growth in price of oil

$gp_m$  Annual rate of growth in price of Saudi's imports

- $gd_c$  Annual rate of growth in Saudi Arabia's domestic oil consumption  
 $Vm_t$  Value of imports of goods and services, in billions of U.S. dollars.  
 $r$  Foreign rate of interest, 12-month Eurodollar deposit rate  
 $G_t$  Grants and aids to other countries

### B.3 Memorandum

$A_{1977}$  = \$68 billion, source: World Financial Markets, November 1977.

$r$  = 10 percent per year; this is very close to the 12-month Eurodollar deposit rate in June 1979.

$Vm_{1977}$  = \$14.66 billion, converted to U.S. dollars by dividing the value of imports in riyals in 1977 by the exchange rate (3.52 riyals/U.S. \$).

Source: International Monetary Fund, IFS, May 1979.

$Dc_{1977}$  = 166.2 (1000 B/D), estimate, source: OPEC Review, March 1979

$G$  \$3 billion throughout the simulation period: this is the average of Saudi Arabia grants and aid to other countries over 1974-1978, source: World Financial Markets, May 1979.



Appendix  
EXHIBIT A.1

RATIO OF OIL EXPORTS TO EXPORTS FOR SELECTED OIL EXPORTING NATIONS  
(1972-1977)

Country	1972		1974		1976		1977	
	Oil Exports/Exports	Total Exports	Oil Exports/Exports	Total Exports	Oil Exports/Exports	Total Exports	Oil Exports/Exports	Total Exports
Algeria	78.8		89.5		89.2		93.4	
Indonesia	51.4		70.2		70.2		67.2	
Iran	90.0		96.9		97.5		97.3	
Iraq	92.2		98.6		98.3		98.0	
-----								
Kuwait	92.6		94.3		91.1		90.0	
Libya	99.9		100.0		99.9		99.9	
Mexico	1.3		4.1		15.7		22.0	
Nigeria	82.0		93.0		93.3		92.5	
-----								
Saudi Arabia	99.7		99.9		99.9		99.9	
Venezuela	91.4		95.2		94.2		95.4	

Source: IMF International Financial Statistics, January 1979.

## EXHIBIT A.2

## RATIO OF OIL EXPORTS TO TOTAL GOVERNMENT REVENUES FOR SELECTED OIL-EXPORTING NATIONS

(1972-1977)

Country	1972		1974		1976		1977	
	Oil Exports/ Revenues	Total Government Revenues	Oil Exports/ Revenues	Total Government Revenues	Oil Exports/ Revenues	Total Government Revenues	Oil Exports/ Revenues	Total Government Revenues
Algeria	49.3		73.8		NA		NA	
Indonesia	61.0		121.3		84.4		83.3	
Iran	85.2		99.1		84.9		79.4	
Iraq	NA		NA		NA		NA	
-----								
Kuwait	123.9		99.1		92.2		108.7	
Libya	NA		NA		NA		NA	
Mexico	0.5		1.7		6.6		10.7	
Nigeria	114.9		135.2		106.7		110.8	
-----								
Saudi Arabia	NA		NA		NA		NA	
Venezuela	93.0		110.5		93.8		NA	

NA - Government Revenue Data Not Available

Source: IMF International Financial Statistics, January 1979.

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