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Managing a Nonrenewable Resource

Savings and Exchange-Rate Policies in Bahrain

Ibrahim A. Elbadawi
and
Nader Majd

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This paper — a product of the Transition and Macro-Adjustment Division, Policy Research Department, and the International Trade Division, International Economics Department — was prepared as background material for Bahrain's Country Economic Memorandum. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Anna Maranon, room N11-025, extension 31450, or Maria Teresa Sanchez, room S7-022, extension 33731 (April 1993, 47 pages).

Bahrain's oil-producing economy is vulnerable to terms-of-trade shocks for oil in the short to medium run. But the country's dependence on nonrenewable hydrocarbon resources represents a more basic constraint on Bahrain's prospects for long-term economic growth and welfare. To maintain economic growth and welfare in the post-oil era, Bahrain must save more of its oil revenues and assets and use them to invest abroad and to support economic diversification.

Elbadawi and Majd derive optimum domestic savings rates for Bahrain in the context of a two-assets (oil and non-oil) intertemporal welfare-maximizing model. Based on these derived rates, they recommend that the current suboptimal savings ratios be raised by about 10 percent of GDP.

Achieving such a high savings rate is probably not economically feasible or politically sustainable in a stagnant economy, because it implies significantly reducing absolute levels of real consumption. Such austerity would not be necessary in a growing, efficiently restructured, and diversified economy, in which the real exchange rate policy played a key role by stimulating non-oil tradable sectors that could replace oil when it dries out. But the success of real exchange rate depreciation itself depends on a sufficiently high savings rate, to free up resources to switch to the production of other tradables.

Elbadawi and Majd present an empirical three-sector model of the real exchange rate, which permits links between the equilibrium real exchange rate and the optimum savings rate. They use this model to compute what real depreciation is required consistent with the derived optimum savings ratios.

Their model predicts that a real depreciation of about 31 percent would be needed between 1992 and 2005 to avert serious real overvaluation over this period.

MANAGING A NONRENEWABLE RESOURCE: SAVING AND EXCHANGE RATE POLICIES IN BAHRAIN

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This paper is prepared as a background material for the Bahrain's Country Economic Memorandum. Any views expressed here, however, are not necessarily those of The World Bank or affiliated organizations. Helpful comments from W. Tyler, S. Khenissi, H. Hashimoto, W. Martin, I. Diwan, an anonymous referee, and especially W. Easterly are gratefully acknowledged.

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I. Introduction

The mainstay of the economy of Bahrain is provided by the oil and gas sector which accounted for almost 70 percent of total exports over the 1986-90 period, more than 60 percent of government revenue and more than 18 percent of GDP. Furthermore, government expenditure (provided for by the oil revenue) influences non-oil GDP through its effect on infrastructure and services sectors, the two main components of the non-oil GDP (see figure 1).[1] The country's dependence on the nonrenewable hydrocarbon resource base, however, imposes a fundamental constraint on Bahrain's prospects for future economic growth and welfare. Except for the unlikely event of major new discoveries, the country's oil reserves fields will dry out in about the next fifty years if the current rate of extraction is maintained in the future.[2]

It is now widely understood that in countries where the mainstay of the economy is a depletable resource base (oil), the oil extraction-and hence current national income-reduces future national income. So an exceptionally sizeable part of oil sales (national income) must be saved and allocated to future income generating (domestic and foreign) assets, in order to sustain the same standard of living in the post-oil era as well.[3]

The implication of this analysis for Bahrain-and other oil dependent economies for that matter-is quite dramatic. It is shown below that for Bahrain to be able to maintain its standard of living after the oil era and to restructure and develop a viable no-oil based economy, it may have to achieve a high domestic saving rate over the remaining years of the oil economy. The initial levels of the required saving rate could be as high as 50 percent of GDP,[4] before declining to normal levels at

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[1] More details on Bahrain's sectoral distribution of output and fiscal operations are provided in tables 1-3 of the following section.

[2] Currently production at the on-shore fields is at 42,000 bd, while that of the off-shore Abu Saafa fields is at 72,000 b/d, see Section II-2 and Appendix (A) for a precise description of the expected profile of future oil extraction in Bahrain.

[3] The literature on optimal national saving under an irreproducible resource base economy includes: Dervis, Martin and van Wijnbergen (1984), Gelb (1985a,b), Farzin (1989), and Askari (1990), to mention a few examples.

[4] As we will see below, however, over the first half of the 1980s, actual national saving was not far below the 50% rate.

the time of the extinction of the oil reserves. The attainment of this saving rate (or something close to it) should be the most important objective of Bahrain development strategy. The achievement of such a high saving rate, however, is likely to be economically infeasible and politically unsustainable in a stagnant economy, since it will imply significant reductions in the absolute levels of real consumption. Such austerity will not be necessary in a growing economy in which the incentive structure is allowed to shift resources to the comparative advantage sectors, and hence to facilitate an efficient restructuring of the economy.

Once adequate resources in the economy become available as a result of sufficiently high national saving, the key variable that determines efficient resource allocation across sectors is the real exchange rate (RER). To give a simple generic definition of the RER, it is convenient to view Bahrain as an economy composed of two sectors, tradables and nontradables. The tradables are commodities which are traded in the international market or are close substitutes for internationally traded goods; for a given set of nominal exchange rate and commercial policies, the prices of traded goods are determined by international prices. Oil, machinery, and aluminum are example of traded goods in Bahrain. The prices of nontraded goods on the other hand, are determined by the conditions of domestic supply and demand. Examples of such goods are construction and housing or haircuttery services. The RER is defined as the relative index of the aggregate price of nontradables to the price of tradables.

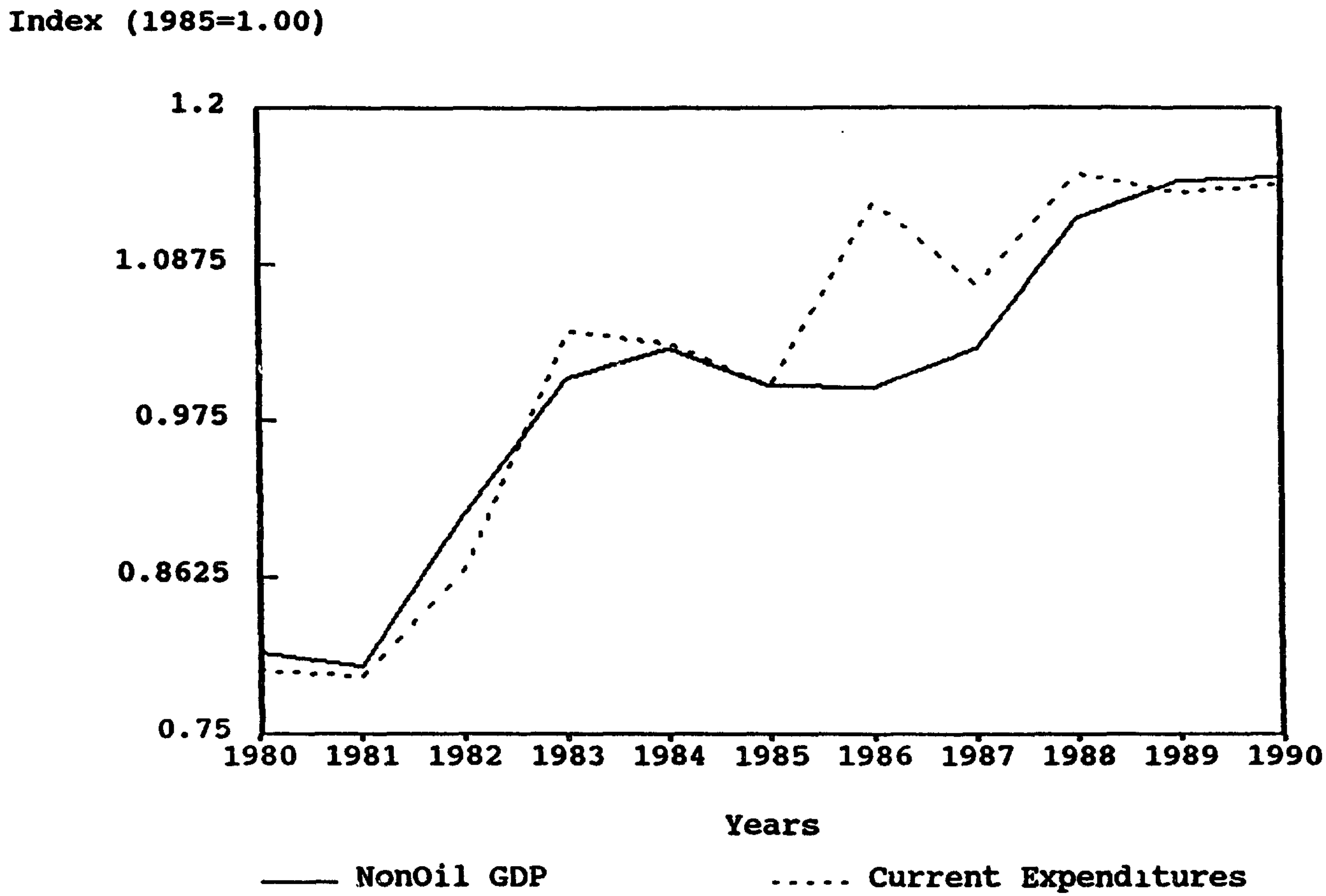
An appreciated (high) RER means that the structure of incentives in the domestic economy is probably biased against the tradables and in favor of the nontradables. If this appreciated RER is in fact high enough relative to its equilibrium, then the RER is also overvalued. An overvalued RER discourages the production of tradables and helps expansion of the nontraded goods sector, while at the same time it makes traded goods relatively cheaper and hence it encourages more imports and further reduction of exports. Therefore, RER overvaluation can substantially worsen the current account deficit. Moreover, its net spending effect may reduce domestic saving and may also lead to reduced growth for open economies which have strong potential for export expansion or efficient import substitution. Clearly given its need to generate a higher domestic saving rate in a growing and a more diversified economy, Bahrain can ill afford an overvalued RER.

From the above discussion it is obvious that an adequate macroeconomic framework for Bahrain should integrate the two fundamental concepts of the optimum (desired) saving rate and the equilibrium real exchange rate (ERER). Section II provides a brief review of recent macroeconomic policy and national saving in Bahrain, while section III gives the derivation of optimum saving rates and compares them with the observed historical rates. Section IV discusses a model of ERER determination that relates the ERER with trade balance among other fundamentals. Two simple specifications related to this model will then be estimated using annual Bahrain data. One specification estimates the long-run determination of the ERER, while the other estimates the short-run dynamics of the RER. In Section V, the long-run estimated specification will be used to generate an index of ERER consistent with 'desired' saving rates; in turn the derived ERER will be compared with the observed to compute RER misalignment. Furthermore the dynamic equation will be employed to suggest a future nominal exchange rate parity for Bahrain, given projected RER misalignment.

Finally Section VI concludes by providing an outline of a strategy on how to achieve RER depreciation and avert RER overvaluation in Bahrain. The discussion will center around the trade-offs between commercial policy and devaluation as instruments for validating the depreciation of the RER triggered by expenditure reducing macroeconomic policies. In this regard the key role of cutting the fiscal deficit and reducing government expenditure - especially current expenditure - will be emphasized. Also this section will include a brief discussion of the issue of RER stability. It will

be argued that RER depreciation called for by the evolution of the ERER is not necessarily incompatible with stability of the RER.

Figure 1: BAHRAIN
NON-Oil GDP and Government Expenditures



II. Recent Macroeconomic Policy and National Saving in Bahrain (1980-90)

Bahrain is a small open economy dominated by oil and gas. The non-oil economy is largely driven by a large public sector, mainly through government budgetary expenditures. In recent years the authorities have initiated a series of economic diversification efforts aimed at developing an export-oriented, energy-intensive manufacturing sector based on domestic natural gas resources, fostering an offshore financial center by opening of some 80 offshore banks, improving the country's infrastructure, and bringing on stream the Aluminum Bahrain (Alba) smelter.

A summary of Bahrain's macroeconomic developments over the past decade is provided in Table (1) (a more detailed account of the evolution of the economy over the period 1980-90 is contained in Appendix Tables (A.1) and (A.2)). During much of the 1980s, the increased oil revenue has made it possible for the government to finance higher public expenditure programs while at the same time being able to enjoy surpluses in both public sector accounts and external current and overall positions, despite higher imports. During this period, the economy has prospered with high growth rates of the real GDP and improved standard of living.

By 1989, however, the already weakening world petroleum prices resulted in an erosion of Bahrain's financial and economic positions. The overall fiscal account returned to a deficit by as much as 11 percent of the GDP while the external current account, excluding official grants, recorded a sizable deficit of around 6 percent of the GDP. But in 1989 GDP grew by 2.5 percent before decelerating to 1.2 percent in 1990. Although the value-added in the hydrocarbon sector expanded by 4.3 percent, the official estimates indicate that the real non-oil GDP rose by only 0.2 percent, mainly due to sharp contractions in the financial, insurance, and transport and communication sectors. The real GNP growth rate increased by 9.5 percent.

During 1989-90, domestic consumption as a percentage of the GDP declined by almost 2 percent, from about 64 percent in 1989 to around 62 percent in 1990 and the fixed capital formation of the private sector fell by 1.5 percent. While the gross domestic savings rate as a percentage of the GDP increased by more than 2 percent, from about 36 percent in 1989 to 38 percent in 1990, it was far below the average saving rate of around 50 percent during the first half of the 1980s.

Furthermore, a closer look at the evolution of domestic savings in Bahrain shows how the country's savings efforts have deteriorated during the 1980s. The severe plunge in the government saving rate, from about 22 percent of the GDP in 1980 to less than 6 percent in 1990, seems to be the major factor behind the worsening of the overall domestic saving situation in Bahrain.

In the second half of the 1980s, the government revenue from oil and gas declined sharply as the world market prices for oil fell. Meanwhile, the non-oil revenue as a percentage of the GDP increased by more than 2 percent, from about 9 percent in 1985 to more than 11 percent in 1990 (see Table 1). However, the government current expenditures remained relatively high, at about 30 percent of the GDP during 1988-90, to erode much of the positive impact of the higher non-oil revenue on the government savings.

The evolution of domestic savings in Bahrain would be depicted better if we compare the time trends of the private *vis-a-vis* public sector savings. Figure 2 shows that the private savings has been more or less procyclical during much of the 1980s. During the boom periods, the private saving rate as a percentage of GDP increased whereas during the periods of slump it followed the suit and declined. For example, during the recessionary period of 1981-82 the ratio of private savings to GDP was at its lowest point (about 29 percent) whereas in 1983 and 1988, when the economy was expanding rapidly, by more than 8 percent and 7 percent per annum respectively, the savings rate reached its peak of more than 35 percent of the GDP.

On the other hand, the government savings appears to have been countercyclical. During 1981-82, when the economy was in recession, the government savings was at its maximum. In 1983, the saving rate declined to almost 13 percent of the GDP when the rate of growth of the GDP was 8.5

percent. In 1988, it reached its lowest point of about 2 percent of the GDP, when the economy was expanding by about 7 percent. However, the government savings continued to increase when the accelerating pace of the economic growth reversed in 1988-90. In addition, increases in the government current expenditures have been the main source of investment, but also public sector deficit since apparently it remained unmatched by increased revenues. By the late 1980s, the budget deficit increased sharply and reached to about 11 percent of the GDP in 1987 and 1989 and 9 percent in 1990 while the share of the public sector fixed capital formation in GDP plummeted by more than 3 percent from about 12 percent in 1985 to a little over 8 percent in 1990.

In more recent years, Bahrain's balance of payments position has deteriorated despite positive resource balance mainly provided for by improvements in the terms of trade. The current account deficit, excluding official capital grants, reached 6.5 percent of the GDP in 1989 and 5.6 percent in 1990. As Table 1 shows, the slight improvement of the current account deficit in 1990 can somewhat be attributed to the sharp gain in the purchasing power of oil exports [PPE measured as ($P_{Oil}/P_{Non-oil}$) *Oil Export Volume Index] in that year. Nonetheless, the decade of the 1980s has witnessed an erosion of the purchasing power of oil exports as the PPE index (1985=100) fell from about 150 in 1980 to about 95 in 1990.

Table 1 also shows the dependence of the Bahrain's economy, especially the country's foreign trade, on oil. As can be seen from the table, throughout the period 1980-90 the non-oil trade balance as a percentage of the GDP has been negative. Similarly, during the same period Bahrain's net factor income and current transfer payments have been negative, reaching 20 percent of the GDP in 1990. Together with the non-oil trade balance, these two items have accounted for a large portion of the current account deficits in recent years. To eliminate the adverse effects of the BOP deterioration in the second half of the 1980s, the authorities had to recourse to a policy of drawing down on

international reserves while seeking official capital grants from the neighboring oil-rich countries (Table (A.2)).

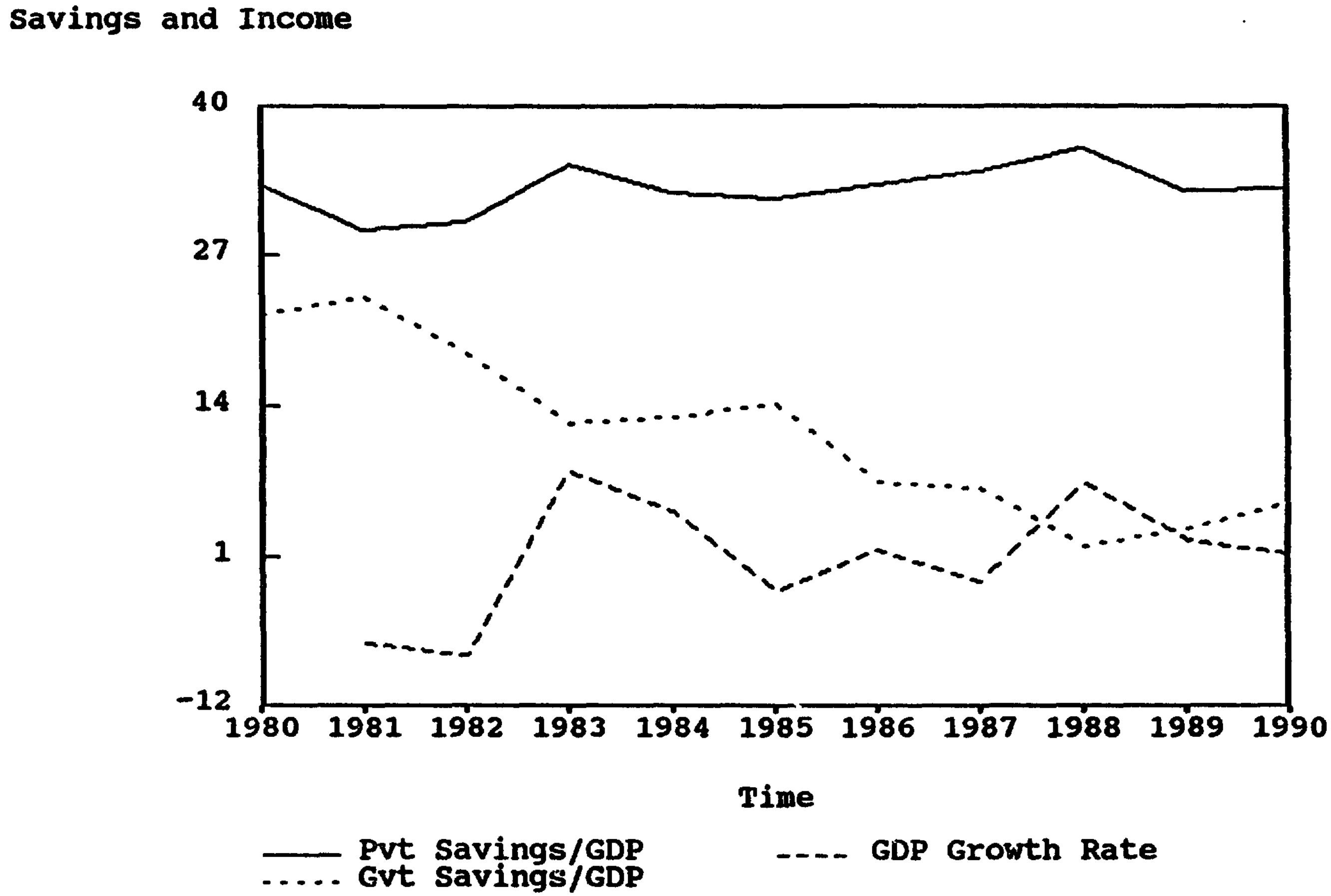
Such a policy, while being effective in the short run will be ill advised as a long-run strategy, especially given the country's short-lived on-shore oil reserves which under the most optimistic scenario wouid not last longer than 15 years. The need for higher savings rate for Bahrain appears to be more pressing today than anytime before because the country's present national savings rate of about 20 percent is by far less than the similar rate in other oil-producing countries', let alone the 'optimum' or 'desired' saving rate (see below).

Table (1)
Summary of Macroeconomic Indicators
in Bahrain

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
GDP Growth Rate (%)		-6.6	-7.5	8.5	4.9	-2.0	1.6	-1.2	7.3	2.5	1.2
Total Revenue and Grants	38.5	41.2	40.4	34.9	34.8	38.2	35.5	35.8	31.8	32.5	33.9
Oil and Gas Revenue	28.2	30.6	29.4	23.3	24.1	26.9	20.5	20.7	16.6	18.4	20.9
Non-Oil Revenue	5.4	6.1	6.9	8.3	8.1	8.6	11.8	11.9	12.2	11.3	11.2
Total Expenditures	27.4	29.2	34.6	38.1	36.0	35.7	39.8	38.2	38.2	36.8	36.6
Surplus or Deficit (-)	11.1	12.0	5.9	-3.2	-1.2	2.4	-4.3	-2.3	-6.4	-4.3	-2.7
Consolidated Public Debt (% GDP)	8.4	7.8	8.1	8.4	8.8	7.6	11.4	13.9	20.2	20.3	14.8
Gross Domestic Savings	55.0	52.7	48.5	47.6	45.4	46.1	40.6	41.2	38.2	36.1	38.3
Government Savings	21.9	23.4	18.6	12.6	13.1	14.2	7.4	6.9	1.9	3.4	5.6
Export Price Index (1985=100)	106.9	118.4	117.9	106.2	95.1	100.0	58.2	68.7	65.5	74.9	88.6
Non-Oil Import Price Index	104.9	105.3	103.7	101.4	99.2	100.0	117.9	129.5	138.9	138.0	145.8
Manufacturing Real Wage Index	171.9	172.2	139.0	131.0	137.3	100.0	115.0	127.7	152.1	150.2	153.7
Terms of Trade	105.3	107.3	106.3	102.8	97.6	100.0	88.3	93.3	96.5	101.1	100.7
Nominal Effecive Exchange Rate	100.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Real Effective Exchange Rate	78.2	86.5	96.9	100.5	102.0	100.0	81.4	70.4	64.6	65.4	60.1
Oil Export Volume Inedx	130.4	145.1	109.4	101.4	111.8	100.0	138.5	137.3	135.5	138.7	144.3
Purchasing Power of Oil Exports	150.4	139.1	156.6	80.0	105.8	100.0	100.4	89.8	53.8	57.4	95.2
Oil Trade Balance (% GDP)	38.4	39.3	34.8	30.3	29.5	29.9	25.5	23.3	22.2	24.0	28.5
Overall Trade Balance (% GDP)	10.0	11.3	11.3	3.5	3.0	5.6	4.1	6.5	9.8	5.3	16.5
Current Account Balance (% GDP)	6.0	12.4	11.7	2.7	5.6	1.0	-2.2	-6.3	5.7	-3.6	6.2

Source: Government of Bahrain.
/1/ Defined as (Wage/PXalm*NEER), where Wage is the index of wages in manufacturing sector, PXalm is the unit value index of aluminum exports, NEER is the index of nominal effective exchange rate.

Figure 2: BAHRAIN
Evolution of Domestic Savings



III. Oil and the Optimum Saving in Bahrain

An 'optimum' or 'desired' saving rate relative to the GDP-has been computed at about 37% for countries which only partially depend on oil such as Egypt, Turkey and Indonesia; for other countries that are more heavily dependent on oil such as Saudi Arabia and UAE the computed saving rate can be as high as 60%.[5] The framework used in such derivations is a small open economy optimizing model comprising of two assets(oil and non-oil). The optimum saving rate can be solved as an explicit function of: the life span of the oil reserves, expected future oil prices and real return on investment, as well as the desirable saving rate in the post oil era.

The model used here is adapted and revised version of Farzin (1989). A detailed formal statement of the model is contained in Appendix A. The model's solution allows the derivation of optimum saving rates subject to the following specific assumptions:

(1) A fixed extraction rate for Abu Saafa oil field for the first 15 years then declining by 6%. Immediately following the base period (1990), a declining extraction rate at 6% for the on-shore oil fields.

(2) The on-shore oil fields' reserves are assumed to last for 15 years, while that of Abu Saafa are assumed to remain productive for 50 or for 85 years.

(3) Oil prices are assumed to remain fixed in real terms.

(4) The real rate of return on investment are assumed to be 2%.

(5) The optimal post-oil domestic saving rate is set equal to 25% or 30%.

The 50 years assumption about the life span of the oil reserves in Abu Saafa reflects more or less the best available knowledge about the technology of production in the oil sector of Bahrain. The 85 years assumption is merely considered for comparison, therefore, only the 'optimum' saving rates

[5] For example see Dervis, Martin and van Wijnbergen (1984) for the case of Egypt, Farzin (1989) for Kuwait, and Askari (1990) for Saudi Arabia.

based on the 50 years assumption will be used in the subsequent ERER analysis. Finally the assumptions about the real rate of return and post-oil saving rates follow the ones suggested in similar studies (such as a recent World Bank study on UAE). The former is based on international rates of return on investment, while the later is based on the average rate of domestic saving prevailing in the developed countries.

The alternative estimates for the domestic saving rates are presented in Table 2 and are also shown in Figure 3.[6] These estimates are based on various sets of the parameter values stated above. The time path of the saving rates are traced for 10-year intervals. Comparison of columns (2) to (3) and (4) to (5) confirms that, other things equal, the larger the post-oil saving rate, the higher the initial optimal saving rate. The same comparison also shows that everything else being equal, the shorter the reserve life, the higher the initial optimum saving rate and the faster it approaches the post-oil saving rates, however, in this case the differential in initial domestic saving is rather marginal. These two outcomes appear consistent with a more risk averse attitude towards future income and consumption flows and/or a stronger preference for the welfare of future generations over the present generation (i.e. a lower discount rate of time preference).

The optimum saving rates profile we will select for further analysis in this paper is the one based on 50 years life span of off-shore oil and 30% post-oil national saving rate (column 4 of Table 2). In 1980 for example, Bahrain's actual saving rate was close to 55%. A comparison of this optimal savings rate (column (4) of Table 2) with the actual saving rate in Bahrain (Table 1) shows that over the second half of the 1980s the domestic saving rates were not sufficiently high to be within the optimal range. Over the first half of the 1980s, the actual saving rates were close to the optimal, however. The rates declined sharply during the second half of the 1980s, primarily due to

[6] Note that this model does not account for net factor payments and net transfers, in the sense that national saving rate is equivalent to domestic saving rate.

depressed oil prices and revenues. This highly suboptimal level reflects the fact that the authorities chose not to adjust expenditure to levels consistent with the lower oil revenue. On the contrary, the government continued to subsidize consumption at the expense of savings, particularly by spending generously on social and economic services. By the year 1990, the domestic saving rate (Table 1) fell sharply to about 39 percent of the CDP from about 55 percent in 1980. Clearly, given such a sub-optimal saving rate, lower aggregate consumption, but more importantly, higher economic growth will be needed for Bahrain to maintain a comparable standard of living for future generations.

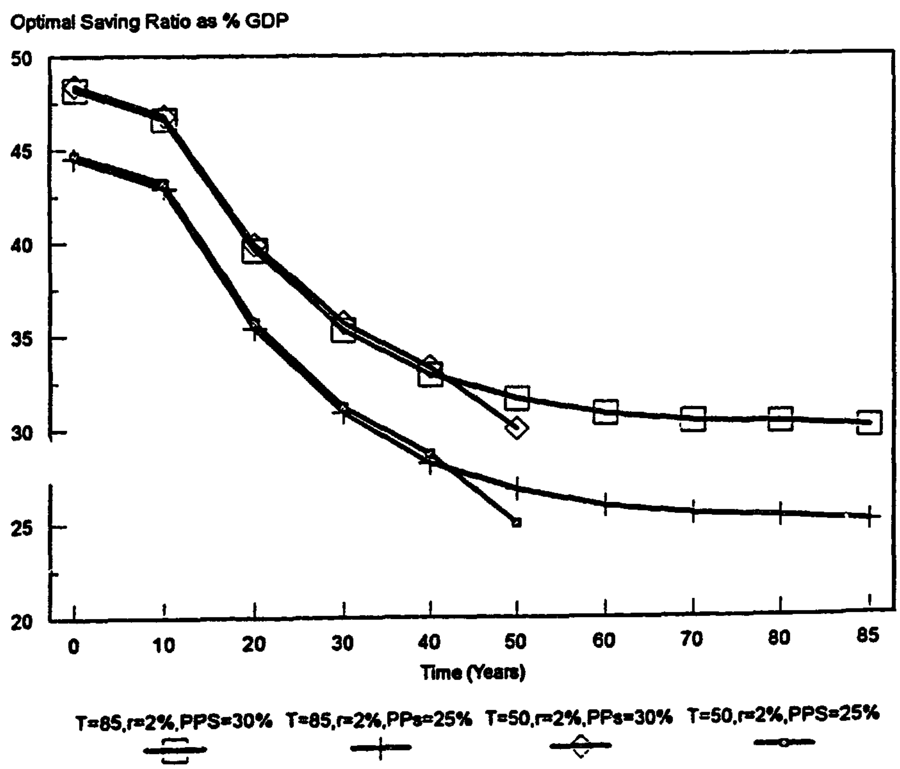
Consequently, the government fiscal policy needs to be adjusted to bring down the level of public expenditures. The high level of fiscal deficits of about 11 percent of the GDP during the period 1987-90 (the year 1988 is an exception) appears not to be sustainable in the future. Given the fact that in Bahrain an adequate tax instrument (other than trade taxes) is virtually nonexistent, it is important for the government to save and accumulate non-oil capital assets out of the oil windfalls during the boom periods to bring the present sub-optimal domestic saving rate closer to the optimal saving ratio, initially estimated at about 48 percent.

Table 2: Time Path of Optimal Saving Ratio (Percent of GDP)

(1)	(2)	(3)	(4)	(5)
Parameters / Time	T=85,r=2% PPs=30%	T=85,r=2% PPs=25%	T=50,r=2% PPs=30%	T=50,r=2% PPs=25%
t= 0 (1990)	48.2	44.5	48.4	44.7
10	46.6	42.9	46.8	43.2
20	39.6	35.4	39.9	35.8
30	35.3	30.9	35.7	31.2
40	32.9	28.2	33.3	28.7
50	31.5	26.7	30.0	25.0
60	30.8	25.9		
70	30.5	25.5		
80	30.3	25.3		
85	30.0	25.0		

Note: T = the life of the oil reserve
r = the real rate of return
Pps = Post-oil domestic saving rate

Figure 3: Bahraim: Time Path of Optimal Saving Ratio



IV. The Empirical Model of the RER

Consider an economy producing three types of goods, nontradables (N), oil exportables (x_o) and importables (m), the prices of x_o and m, being tradables goods are given by:[7]

(1) $$P_{xo} = P^{*}_{xo} \cdot E(1-t_{xo})$$

(2) $$P_m = P^{*}_m \cdot E(1+t_m)$$

where P^* stands for the internationally determined foreign prices given in US dollars, E is the nominal exchange rate in BD/Us$, and t_{xo}, and t_m are the corresponding foreign trade tax rates. now let the price of nontraded goods be given by P_N and let G and Y stand for nominal aggregate government expenditure and nominal GDP, respectively; then define domestic absorption A as follows:

(3) $$A = GDP + M - X$$

now we can state the equilibrium condition in the nontraded goods market where the demand for nontraded goods D_N is set equal to the supply S_N.

(4) $$D_N\,(P_{xo}, P_m, P_N, A) = S_N\,(P_{xo}, P_m, P_N, Y)$$

[7] For the case of Bahrain we could have considered a further disaggregation of exports into oil (xo) and non-oil, but lack of data on an aggregate non-oil export price index precluded that.

The solution of condition (4) using (1)-(3) gives the expression for the ERER where the RER is given by P_N/P_T, and P_T is the weighted index of P_{xo}, and P_m (see for example Rodriguez (1989); Elbadawi (1992); and Edwards (1989)).

$$(5) \qquad ERER = ERER\left(\underset{(?)}{\frac{P_{xo}}{P_m}}, \underset{(?)}{\frac{G}{Y}}, \underset{(+)}{\frac{M-X}{Y}}\right)$$

where the signs in parenthesis indicate the signs of ERER partial derivative relative to its arguments.

According to the above equilibrium condition, the RER should depreciate (RER to decline) as the trade deficit declines (or the trade surplus increase). The reason is straightforward: a larger trade surplus means a reduction in spending relative to income. At least some of the reduction must fall on nontraded goods so their price must fall (so the RER comes down). Subject to plausible assumptions regarding investment n Bahrain, the trade balance can be shown to be directly related to the saving rate, which means that a higher saving rate is not sustainable without RER depreciation (See Section V below).

An increase in overall government spending for a given trade deficit ratio ((M-X)/Y) must imply that government share in total spending has increased at the expense of private spending. In this case an increase in G/Y will lead to an RER appreciation (depreciation) provided that the government propensity to spend on nontraded goods is higher (lower) than that of the private sector. This accounts for the fact that the sign of the G/Y effect could not be determined a pricri. Also the domestic terms of trade for oil exports relative to imports $\left(\frac{P_{xo}}{P_m}\right)$ have indeterminate signs depending on their relative weights in the construction of RER. As can be seen from equations (1)-(2) above, this indicator reflects the joint effects of the international terms of trade $\left(\frac{P^*_{xo}}{P^*_m}\right)$ and the tax policy on foreign trade. In Bahrain, however, the first factor basically accounts for all of the movement in the domestic tradables' price ratio. As an empirical regularity,however, governments tend to have higher propensities to spend in the nontraded goods sectors; and in the case of a dominant export sector like oil in Bahrain a large increase in its price relative to imports or other exports will generate significant spending effects. So that an increase in aggregate government spending rate or the relative price of oil is likely to lead to an RER appreciation.

IV.1 An Econometric Model for Bahrain:

In what follows, we estimate a linear logarithmic version of equation (5) above using annual Bahrain data for the 1975-90 period. As we mentioned in the introduction to this paper, we will interpret equation (5) above as describing the long-run evolution of the equilibrium RER for given 'sustainable' values of the fundamentals.[8] The estimation results of equation (5) are presented in equation (6). A dynamic specification of RER short-run behavior was also estimated (equation (7)), using an error-correction framework.[9]

The RER data is the IMF multilateral index.[10] The Appendix Table (A.3) contains the data on the RER and its fundamentals used in the estimation of the ERER model (equation (6)), and the corresponding error-correction equation (7).

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[8] The justification of the above interpretation requires that the individual variables that enter into the equation be cointegrated (e.g. Edwards (1989) and Elbadawi (1992), pp 14-24). The relatively short length of the data precluded formal tests for cointegration.

[9] If a cointegrating relationship exists, Engle and Granger (1987) show that it is also consistent with a dynamic error-correction model.

[10] The RER multilateral index is defined as the nominal effective exchange rate index adjusted for relative movements in national price or cost indicators of the home country and its partner -- or competitor -- countries.

(6) $$\log \hat{ERER}_t = \underset{(-3.70)}{-0.037}\,TREND + \underset{(8.86)}{0.66}\,\log\left(\frac{P_{xo}}{P_m}\right)_t$$

$$+ \underset{(5.36)}{0.61}\,\log\left(\frac{G}{Y}\right)_t + \underset{(4.00)}{2.47}\,((M-X)/Y)_t$$

$R^2 = 0.73$, $\bar{R}^2 = 0.67$, $DW = 1.41$

(7) $$\Delta \log \hat{RER}_t = \underset{(2.76)}{0.39}\,(\log \hat{ERER}_{t-1} - \log RER_{t-1})$$

$$+ \underset{(2.08)}{0.18}\,\Delta \log\left(\frac{P_{xo}}{P_m}\right)_t$$

$$+ \underset{(3.34)}{0.93}\,\Delta\left(\frac{M-X}{Y}\right)_t + \underset{(0.63)}{0.11}\,\Delta \log\left(\frac{G}{Y}\right)_t$$

$$- \underset{(3.77)}{0.80}\,\Delta \log (NEER)_t$$

$R^2 = 0.88$, $\bar{R}^2 = 0.83$, $DW = 1.39$

where t-statistics are in parenthesis and NEER stands for nominal effective exchange rate. Despite the rather small sample available to us, the estimation results are fairly satisfactory, and broadly corroborate the predictions of the theoretical model.

Starting with equation (6), the estimated regression explains over 73% of the variation in RER. The terms of trade for oil relative to imports has a statistically significant and positive effect on the RER with an elasticity of 0.66; ceteris paribus, a temporarily improvement in the TOT for oil exports by 40% (say) can lead to about a 26% real overvaluation. This is because the oil boom will increase government revenue and therefore allow for further government spending, which in turn leads to higher private sector domestic absorption. The net effect is a higher demand for both traded an nontraded goods, and since the prices of traded goods are given and the price of nontradables goes up, an RER appreciation will ensue. The appreciated RER will encourage excessive importing while the domestic production of imports and other minor exports will be further marginalized. The non-oil trade deficit will widen and possibly even the aggregate trade balance may deteriorate. This result also imply that a medium to long run worsening of the TOT will require an equilibrium real depreciation.

Hence the economy will be in its weakest condition when suddenly the TOT for oil move to the other side, as it did in Bahrain; where it improved significantly over most of the first half of the 1980s, but only to worsen substantially over the second half. Clearly in this case the observed expansion in aggregate spending over the first period is not sustainable, and the RER appreciation is not called for by a change in the ERER. An oil price (or quantity) boom is also likely to have a deleterious effect on other minor exports-through the same spending effect channel. This effect is known in the literature as the 'Dutch Disease' effect.[11] In terms of our model, this influence of the oil price boom could be reflected by the influence on the ERER of the relative price of oil to other non-oil exports (or potential exports). In Bahrain the most important non-oil exports are manufacturing, especially aluminum. The already very small sector of agriculture may have also been negatively impacted as well.[12]

The ratio of aggregate government expenditure has a positive elasticity at 0.61%. The implication of this result is that the government in Bahrain-as in many other countries-tends to have a higher propensity to spend in nontraded goods compared to the private sector. Excessive and

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[11] On Dutch-disease literature see, for example, Corden (1981), Corden and Neary (1982), Neary and van Wijnbergen (1985), Harberger (1981), and Buiter and Purvis (1983).

[12] The manifestation of this effect on agriculture is vividly reflected in the expansion of the nontraded housing sector at the expense of horticultural land in Greater Manama. For the given technological and microeconomic incentive conditions in Bahrain today, the prevailing RER and the flow of cheap and mostly subsidized agricultural imports render agriculture to be unattractive compared to the service sector.

unsustainable government expenditure, therefore, leads to RER appreciation and overvaluation. If the requirement of increasing the domestic saving rate requires a permanent cut of 10% (say) in the ratio of government expenditure to the GDP, our model suggest that this will lead to about 6% depreciation in the ERER. Cutting the fiscal deficit and reducing government unsustainable expenditure are obviously very important for achieving a higher saving rate and improved trade balance,as well as averting RER overvaluation.

The composition of government expenditure matters,however. It has been argued that government development expenditure or government expenditure on capital goods tends to be traded goods-intensive; hence the brunt of the cuts should be borne by current government expenditure. In fact Martin (1991) shows that a reduced share of government expenditure on capital goods-as part of a fiscal retrenchment program in Bangladesh, have had an appreciationary effect on the RER in that country. Furthermore, from an economic growth perspective, a reduction in government expenditure on capital goods especially in key areas such as infrastructure, can substantially weaken the supply response in the economy and hence compromise the prospects for future economic growth. Finally and as expected, the trade deficit ratio has a statistically significant and highly appreciable positive effect on RER with a semi-elasticity equal to 2.45%. In the following section, the resource balance (and government expenditure) are linked to the optimum saving rates, derived in Section III above. In addition to the TOT relative prices -- which are exogenous, this linkage allows the derivation of sustainable ERER fundamentals consistent with the optimum (or desired) saving.

Second, we consider the error-correction equation (7) which gives the short-run dynamic aspects of the RER determination. Here also the results strongly supports the error-correction model, with the effect due to the error-correction term, $(\log \hat{E}RER - \log RER)_{t-1}$, estimated at 0.39 (positive and less than one) and is highly significant. If the fundamentals in the previous period calls for a lower RER than the observed i.e. $\log \hat{E}RER_{t-1} - \log RER_{t-1} < 0$: then since the coefficient is positive, the RER will depreciate (decline) in the following period. This estimate of automatic adjustment (0.39) for Bahrain is much larger than the estimate of 0.19 obtained by Edwards (1989) for a group of developing countries using a partial adjustment model. Even though Edwards' method is different from ours, the comparisons suggests that automatic adjustment in Bahrain is much more effective than the average for developing countries. The estimated coefficient suggests that it takes only 4.6 years to eliminate 90% of an exogenous shock in Bahrain.[13]

The coefficients of the different fundamentals reflect the impact of transitory changes in the fundamentals on the rate of change of the RER. The capital flow and TOT have positive and highly significant short-run effects on RER. The remaining fundamental (G/Y), however, has positive but statistically insignificant influence on RER. Another potential short-run effect on RER is represented by the excess of the rate of growth of domestic credit over the growth of real output. This variable is a proxy for macroeconomic policy (e.g. Edwards (1989)) and should lead to RER appreciation. In our case, and as expected, this factor has a positive but very insignificant effect, however, and was subsequently dropped from the final equation in (7).

Finally, we consider the effect due to the rate of change in the nominal effective exchange rate (in BD/US$). In theory, starting from initial conditions of RER misalignment and for given macroeconomic policy and exogenous fundamentals, a nominal exchange rate depreciation should accelerate the process of RER adjustment towards its equilibrium level. Our results strongly support this role for the nominal exchange rate for Bahrain. Our model predicts that, ceterus-paribus, a 50% effective nominal depreciation leads to about 40% real depreciation. This unusually high efficiency estimated for nominal depreciation, is consistent with the country's long history of low and stable

[13] The number of years to clear α100% of an exogenous shock through 'automatic adjustment' alone can be computed from the formula: $(1-\alpha) = (1 - 0.39)^T$, where T is the number of years. This formula can be obtained by manipulating the error-correction specification in (7).

inflation. Since the Bahrain dinar is pegged to the dollar, this result implies that a depreciating dollar will substantially enhance the country's external competitiveness.[14]

V. Optimum Domestic Saving, the ERER and Real Misalignment in Bahrain

The ERER index is derived by using the estimated model of equation (6) above and measures for 'sustainable' fundamentals. Starting with the historical period (1977-1990), the following assumptions are made in calculation of the data on 'sustainable' fundamentals.

(a). Historical Period (1977-1990):

(a.1) Given the exogeneity (to the Bahrain economy) of the terms of trade, we take the sustainable values for these two indicators to be the five years moving averages of the observed data.

(a.2) The 'sustainable' capital flow ratio-proxied by $\frac{M-X}{GDP}$, is linked to the saving rate through the domestic saving investment gap:

(8) $$\frac{M-X}{GDP} \equiv \frac{I}{GDP} - \frac{Sd}{GDP},$$

where domestic saving is exclusive of net factor payments and net transfers. This linkage between domestic saving and the resource balance is the hallmark of this exercise. To generate consistent resource balance, we use actual historical $\frac{I}{GDP}$ data and an adjusted $\frac{Sd}{GDP}$ data on identity (8). As we noted in Section (III) above, the historical saving rates were close to average optimum rates for the first half of the 1980s. Over the second half of the 1980s, however, historical saving

[14] To infer from this result whether or not a realignment of currency will be appropriate in the case of RER misalignment, depends on the extent to which such a policy could lead to destabilizing expectations that may undermine the stability of the financial system.

rates have dropped from about 46% in 1985 to around 39% in 1990 (see Table 1). Accordingly, the historical saving rates for 1988-90 have been adjusted to gradually approach the optimum rate obtained for 1990. Finally a five years moving average of the residual, $\frac{M-X}{GDP}$, is computed and used as a measure sustainable capital flows.[15]

(a.3) Abstracting from the complexities of the terms of trade effects and thereby calculation of the gross domestic income, we have simply derived consistent data on the government expenditure by exploiting the basic national income identity:

$$\frac{C_g}{GDP} = 1 - \frac{C_p}{GDP} - \frac{Sd}{GDP}, \tag{9}$$

where C_g and C_p stand for government and private consumption, respectively. Here, we use the actual historical data on $\frac{C_p}{GDP}$ in addition to adjusted domestic saving rates in the above identity to obtain $\frac{C_g}{GDP}$ as a residual. Then a five years moving average for the ratio is calculated to give a measure of sustainable government consumption.

(b). <u>Projection Period (1991-2005):</u>

(b.1) For the terms of trade we use World Bank projection data on international commodity prices to form the terms of trade ratios, and the corresponding five years moving average.

(b.2) As before the 'sustainable' capital flows ratio is derived as a residual using identity (8) above, given the following two assumptions, however:

(2.1) The saving rate is given by the optimum saving rate (column (4) of Table 2).

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[15] Strictly speaking, unlike the projection period, the resource balance in the historical period is not behaviorally liked to the optimum saving rate, rather it is obtained residually as the I-S gap.

(2.2) The $\frac{I}{GDP}$ is derived for an average GDP growth rate of 6% and ICOR assumed to decline from the current rate of 17% to almost 7% by the year 2005.[16] Five years moving averages of the residual of identity (8) is then used as 'sustainable' capital flows ratios.

(b.3) For 'sustainable' government consumption, we use as before identity (9) above in addition to the data on optimal saving rate and private consumption. Private consumption will be predicted by the following two simple econometric equations:

$$(10) \qquad \left(\frac{C_p}{GDP}\right)_t = \underset{(52.3)}{0.34}\left(\frac{GDP_{TR}}{GDP}\right)_t - \underset{(14.7)}{0.07}\ DUMMY(1986\text{-}87)$$

$$R^2 = 0.54,\ \bar{R}^2 = 0.49,\ DW = 2.00$$

$$(11) \qquad GDP_{TR} = \underset{(19.4)}{1304.43} + \underset{(6.2)}{42.0}\ TREND$$

$$R^2 = 0.52,\ \bar{R}^2 = 0.47,\ DW = 1.28$$

t-statistics in parentheses. Given the assumed real GDP growth 6%, equation (10) and (11) allow the derivation of future $\left[\frac{C_p}{GDP}\right]$, which together with the optimum rate enable us to obtain the 'sustainable' government consumption ratios as residuals from identity (9); which are subsequently used to construct the five years moving averages.

[16] This assumption is consistent with a reform-based scenario, where greater reliance on small and medium-scale enterprises as well as much better screening of public investment programs is envisaged.

V.1 ERER and RER Misalignment:

Table 3 contains the data on 'sustainable' fundamentals along with the actual RER and its ERER. The corresponding data for the projection period is presented in Table 4. The ERER of Table 3 is adjusted so that its average over the 1979-82 period is equal to that of the actual RER. Over this period the economy achieved the highest resource balance ratio. Table 3 also contains the percentage real misalignment computed as: (RER - ERER)/ ERER * 100%.

According to our calculations, between 1982 and 1991 the accumulated RER overvaluation in Bahrain could have been as high as 71.2%, which gives an annual average rate of real overvaluation of 7.9%. It is remarkable that such a high rate of real overvaluation could happen despite the deep and sustained real depreciation experienced in Bahrain since 1984. The explanation of this finding is provided by the even steeper depreciation experienced by the ERER, given the 'sustainable' evolution of its fundamentals -- most notably the optimum saving rate - driven resource balance (see also Fig. (4)). This finding also shows that analysis of real exchange rate misalignment based on historical comparisons of observed RER levels (i.e. PPP approach) can be very misleading. It is also clear from the graph and the table, that historical RER (and real misalignment) is substantially driven by the oil cycle.[17] This provides yet another indication of the dependence of Bahrain's economy on the oil sector, but it also illuminates the failure of domestic macroeconomic policy in adopting counter-cyclical measures to stem the oil driven tendency towards RER appreciation.

Finally regarding the projection period (1991-2005), we turn to Table 4 (see also Fig. (4)). The table shows an ERER index that continues to decline up to 1992 before rising very slowly -- as the 'optimum' saving rate declines and TOT improves. The ERER, however, remains low and below 60% for most of the projection period. Now using the error-correction equation (7), we can project

[17] Part of RER movements, however, was also clearly consistent with equilibrium behavior.

RER values based on a non-reform scenario for the next 14 years.[18] By comparing these values to our corresponding ERER, we can obtain the required real depreciation over the next 14 years according to the following index: (RER - ERER)/RER * 100%. The accumulated required real depreciation for the 1992-2005 period is estimated at 31.2%, using the above formula. Should a nominal currency realignment be considered, the estimated coefficient of nominal effective exchange rate (NEER) in equation (7) can be used to compute the corresponding required nominal devaluation. It is important to emphasize that nominal devaluation in Bahrain could have destabilizing effects on the country's financial market, a serious concern that has to weigh enormously in any such decision.

[18] In deriving the future RER index using equation (7), we assume domestic macroeconomic policy indicators $\left(\frac{M-X}{GDP}, \frac{G}{GDP}, NEER\right)$ to stay at their historical average. This leaves the TOT index which is constructed from World Bank projections. The derived RER index is presented in Table 4.

Table 3: BAHRAIN
Equilibrium RER and RER Misalignment
(HISTORICAL)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Sustainable Fundamentals														
Terms of Trade: Oil vs Non-Oil Imports	65.7	72.2	78.6	90.6	104.2	112.0	109.9	95.1	84.1	75.0	69.3	67.4	70.2	70.0
Government Consumption as Precentage of GDP (%)	14.7	14.3	14.3	14.8	15.4	16.4	18.3	20.6	22.5	24.3	25.6	26.3	25.5	24.8
Resource Balance as Percentage of GDP (%)	0.0	0.4	3.3	6.6	8.0	7.8	7.0	5.6	4.6	6.9	9.3	13.0	16.8	20.4
Equilibrium Real Effective Exchange Rate														
Actual Real Effective Exchange Rate	94.6	91.2	89.6	78.2	86.5	96.9	100.5	102.8	100.0	81.4	70.4	64.6	65.4	60.1
Equilibrium Real Eff. Exchange Rate	89.7	89.5	84.9	84.6	88.5	93.4	97.1	94.7	90.8	80.5	71.6	62.8	55.5	48.0
Overvaluation (%)	5.4	1.9	5.5	-7.5	-2.2	3.8	3.5	8.6	10.2	1.1	-1.7	2.8	17.8	25.1

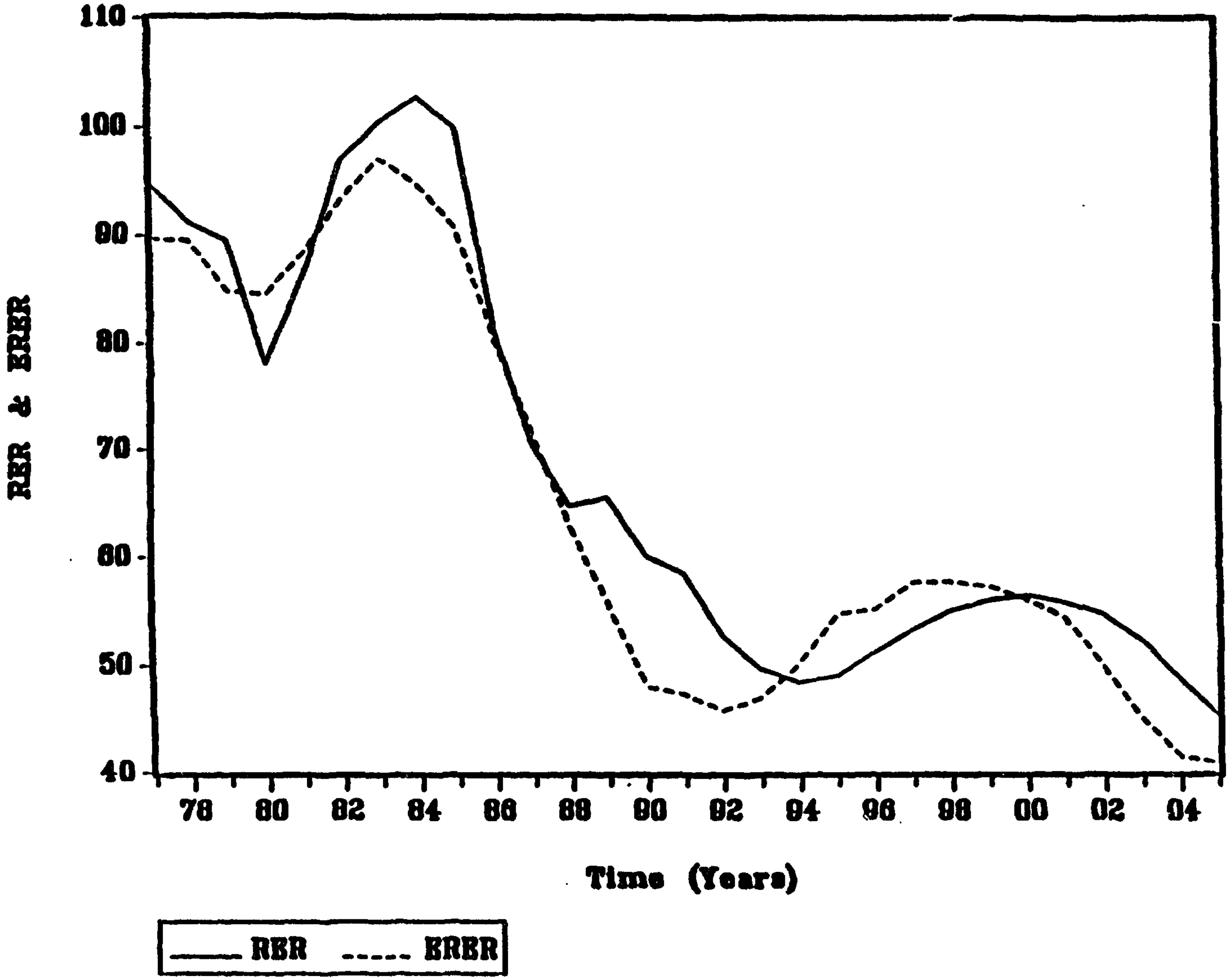
Source: Government of Bahrain, IFS Yearbooks, and staff estimates.
Notes:
(a) All fundamentals are computed as 5-year moving averages.
(b) TOT is obtained from the World Bank projections, while sustainable capital flows and government expenditures as percentage of GDP are derived estimates consistent with adjusted historical saving (see section IV of the text).

Table 4: BAHRAIN
Derived Equilibrium RER and Required RER Depreciation
(PROJECTIONS)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Sustainable Fundamentals															
Terms of Trade: Oil vs Non-Oil Imports	71.7	71.9	69.2	70.1	73.3	77.0	81.1	85.3	88.7	90.3	91.0	90.8	89.8	88.9	87.8
Government Consumption as Precentage of GDP (%)	21.3	19.6	17.3	16.8	16.5	16.4	16.5	17.0	17.5	17.9	18.2	18.4	19.1	19.4	19.7
Resource Balance as Percentage of GDP (%)	19.5	18.8	15.0	11.7	8.6	8.6	7.3	7.6	8.0	8.3	8.7	11.0	12.8	14.9	15.6
Real Effective Exchange Rate															
Actual Real Effective Exchange Rate	58.4	52.6	49.6	48.4	49.1	51.3	53.2	54.9	55.9	56.3	55.7	54.6	52.2	48.8	45.3
Equilibrium Real Eff. Exchange Rate	47.3	45.8	47.0	50.2	54.6	55.1	57.6	57.6	57.2	55.9	54.3	49.9	44.9	41.5	40.8
Required Real Depreciation (%)	23.5	14.9	5.3	-3.6	-11.3	-7.4	-8.2	-4.9	-2.3	0.7	2.6	8.7	13.9	14.9	9.9

Source: Government of Bahrain, IFS Yearbooks, and staff estimates.
Notes:
(a) All fundamentals are computed as 5-year moving averages.
(b) Capital flows and government expenditures as percentage of GDP are derived estimates consistent with optimal saving saving, GDP growth, and assumed behavioral equations for investment and private consumption (see Section IV).
(c) Terms of trade data are based on the World Bank projections.
(d) Actual RER is projected for non-reform scenario (see 1st footnote on Page 29)
(e) Required real depreciation is computed as as (RER-ERER)/RER*100%.
(f) Capital flow as percentage of GDP is defined as (M-X)/GDP*100.

Figure 4: Bahrain:
Actual and Equilibrium Real Effective Exchange Rates



VI. A Strategy for Macroeconomic Reform in Bahrain

In the preceding sections of this paper, we have argued that the fundamental most important issue facing Bahrain today is the achievement of high saving rates, commensurate with the eventuality of the drying out of the country's hydrocarbon resource base, the mainstay of the economy. Furthermore, the required saving rate will not be achievable or sustainable through pure expenditure reducing measures, that relies on reducing the absolute level of real private consumption. A successful adjustment must be part of an elaborate economic reform program aimed at restoring economic growth and diversifying the economy away from oil. For the remainder of this paper we will briefly outline a policy framework to achieve these objectives.

Macroeconomic Policy:

- The starting point is macroeconomic policy, especially fiscal policy. A low fiscal deficit that is financeable on a sustainable basis is the main prerequisite for macroeconcmic stability. High inflation has been averted until now in Bahrain despite the high fiscal deficit (averaging about 9% of GDP over the last five years); due to a combination of drawing from official reserves, extension of subsidies, and to lesser extent imposition of price controls. It is clear that if such process continues in the future it will catch up with the economy in a way or another. For example, the country may end up with diminished foreign assets as its oil resource base continues to decline, in the meantime government borrowing will multiply - leading to higher interest rates-which in turn will discourage investment and effectively crowd out private sector investment. On the other hand, the government may resort to external borrowing to finance the deficit. In both cases, the end result of such fiscal instability will translate into higher inflation and possibly to an unstable currency. Such a gloomy scenario may seem remote but the recent experiences of many African and Latin American countries, some of them oil producing, show that it can happen. For Bahrain, the ultimate target should be a fiscal surplus given the high saving rates required for the sustenance of growth and economic welfare in the post-oil era.

● To achieve higher saving rates both government and private savings have to increase. Since private saving is endogenous to policy, the government must take the initiative by reducing expenditure or raising revenue or both. The reduction of government expenditure clearly contributes to domestic saving, but it also has a direct effect on RER depreciation which help reduce private sector domestic absorption. If government revenues were generated through higher taxes, it will cut directly on private sector real wealth and hence current consumption. Focusing on government expenditure, casual evidence seems to suggest that there exists a considerable scope for achieving substantial reductions. Having emphasized the need for and the feasibility of reducing government expenditure; we must stress that this should not be allowed to lead to an indiscriminate slashing of capital expenditure. Some key types of government expenditure on capital goods can be conducive to the process of RER depreciation, and more importantly they provide the necessary requirements for higher future growth and enhanced private investment.

● The other fiscal instrument is the tax and subsidy policy. In terms of direct subsidies, it appears that nonagricultural subsidies are of a rather negligible magnitude, currently estimated at only BD 2.0m. Some direct subsidies to agriculture are designed to protect local production from heavily subsidized products in neighboring countries, especially Saudi Arabia. Given the difficulty for Bahrain to compete with Saudi Arabia on this score, and that the main cause of the low competitiveness of agriculture in Bahrain may be due to the strong and possibly overvalued currency; we think that subsidies to agriculture should be carefully considered, and especially the subsidies on water charges since it encourages unnecessary depletion of a valuable resource for the country. Furthermore, preliminary evidence suggests that indirect subsidies may be quite substantial; upon correction of the incentive structure through a more appropriate real exchange rate, indirect subsidies could be eliminated which should have positive budgetary implications.

● Given the justified concern in Bahrain about maintaining a tax system comparable to other close regional competitors, most notably Dubai; it appears that, otherwise viable types of taxes such as income and profit taxes are not available options. The one that constitute an option is the sales tax, which in addition to being a nondistortionary tax, it can yield considerable revenue. The other most viable source of revenue is cost recovery and service fees; given their current low rates and small coverage. At any rate, in our view, the guiding principles regarding tax policy in Bahrain should be; not to make the tax policy a substitute for much needed fiscal retrenchment, and that it should not compromise the competitiveness of the economy. Therefore, the tax should not be excessive or distortionary, and it should be as minimal and as transparent as possible.

Real Exchange Rate Depreciation:

● For a given level of government expenditure, a depreciated RER plays an important role in reducing real private expenditure. More importantly, a depreciated RER also provides the much needed economy wide signal for resource allocation; which can substantially facilitate the process of restructuring and growth of the Bahrain economy, given its open economy and its relatively developed and functioning markets. The assessment of the benefits of RER depreciation,especially when it is called for by equilibrium consideration; should be based on dynamic or forward looking criteria, since the enhanced competitiveness of the economy may allow for the growth and expansion of currently marginal or nonexistent sectors. For example, a candidate for possible expansion under a more depreciated RER in Bahrain is agriculture which at present comprises less than 1% of the GDP.

● Perhaps it may not be difficult to agree on the need for RER depreciation in Bahrain given the country's sluggish growth performance, the persistent non-oil negative trade balance,and the negative private saving, among others. There may be some controversy, however, regarding what is the appropriate set of instruments for achieving RER depreciation. There are two main possible options. The first one is to use fiscal policy based on a combination of government expenditure cuts and tax policy. Given the large magnitude of RER overvaluation predicted by our model, the required fiscal austerity may be quite severe. Experience with such types of adjustment show that they tend to be slow and costly, and in most cases unsustainable. This has been the case in the experiences of Cote d'Ivoire, Senegal and other CFA franc countries (e.g.) Devarajan and de Melo (1990) and Elbadawi and Majd (1992)). Despite the dissimilarities between the economies of these countries and that of Bahrain, these countries' currency like the Bahrain Dinar, is also fully convertible and is pegged to a major international currency. Furthermore, should this strategy require high taxes then it may seriously compromise Bahrain's competitive position as a regional business center.

• This leaves us with the other option which is based on both fiscal policy and a devaluation of the nominal exchange rate. Clearly once government expenditure is sufficiently cut and maintained at the new level, a nominal devaluation can accelerate the process of adjustment towards the equilibrium real exchange rate, with minimal cost to the economy in terms of output loss or inflation. On the other hand, however, given the strong economic interdependence between the GCC member countries; a non-coordinated unilateral decision to devalue on the part of Bahrain is not likely. The other main concern about a devaluation based economic reform is that it may endanger the nominal and real stability of the BD, a matter of great concern for an open economy such as Bahrain.

• With or without a devaluation, the success of economic reform depends on strong sustainable macroeconomic policy and the existence of flexible factor and product market. By developing countries' standards, only a few distortions exits in Bahrain's economy. But some of these distortions like the one in the labor market, are significant and their removal could have high payoffs for the economy.

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Appendix (A)

In a two assets economy composed of an exhaustible resource base (oil and gas) and a renewable capital stock, the model derives the rate of capital accumulation, consumption and saving that maximizes society's welfare during and after the oil era. Formally, the planning problem is to choose the consumption profile c(t) and resource extraction rate E(t) so as to:

(1) Maximize $W = \int_0^\infty e^{-\varrho t} U(C(t))\,dt$ (1.a)

subject to: $\dot{K}(t) = P(t)E(t) + rK(t) - C(t)$ (1.b)

$E(t) = -\dot{R}(t)$ (1.c)

$K(0) = K_o$, given (1.d)

$R(0) = R_o$, given (1.e)

$C(t), E(t), R(t), K(t), P(t) \geq 0$ (1.f)

where:

W = Discounted present value of utility stream resulting from consumption flow C(t)

C(t) = Aggregate consumption level at time t

U(C(t)) = Utility associated with consumption C(t)

ϱ = Social rate of time discount, $(\varrho > 0)$

r = Average real rate of return on capital assets, $(r > 0)$

K(t) = Stock of capital assets in the non-petroleum sector

R(t) = Proven petroleum reserves at time t

E(t) = Petroleum extraction rate

P(t) = Petroleum price in real terms

and a dot over a variable implies partial derivative relative to time. Regarding the optimality conditions for resource extraction, it can be shown that the following hold:

$$(2) \qquad E(t) = \begin{cases} \bar{E}(t) > 0 \ \ for \ \frac{\dot{P}}{P} \leq r \\ 0 \ \ for \ \frac{\dot{P}}{P} > r, \end{cases}$$

where $\bar{E}(t)$ is the maximum level of extraction.

That is as long as the rate of increase in the resource price is equal to or exceeds the real rate of return on the reproducible capital, the optimal extraction rate will be given by the maximum allowable by existing technological capacity.[19] World Bank projections regarding future real prices of oil and real rate of return on international investment, rules out the case $\frac{\dot{P}}{P} > r,$ since oil prices are projected to remain fixed in real terms. Based on this and the prevailing view on the technology of oil production, we now state the following path for real prices of oil and for oil extraction rates in Bahrain.

(3.1) $P(t) = \bar{P}$ for all t

---

[19] Actually more formally stated: $E(t) = \bar{E}(t) \ for \ \frac{\dot{P}}{P} < r \ but \ E(t) > 0 \ for \ \frac{\dot{P}}{P} = 0,$ and in this later case the economy will be indifferent for any level $0 < E(t) \leq \bar{E}(t)$. In practice, however, it would be optimal to extract the maximum allowable by the prevailing production technology.

$$(3.2)\qquad E(t) = \begin{cases} \bar{E}_{AS}(0) + \bar{E}_B(0)\, e^{-0.06t} & 0 \le t \le 15 \\ \bar{E}_{AS}(0)\, e^{-0.06(t-15)} & 15 < t < T \\ 0 & t \ge T \end{cases}$$

where $\bar{E}_{AS}(0)$ is the current (1990) extraction rate from the off-shore Abu-Saafa which would remain at the present level of around 27 m. barrel a year for the next 15 years before declining by about 6% before drying out after T years. $E_B(0)$ is the extraction rate in Bahrain in the base year, which is assumed to decline at a rate of 6% before drying out after 15 years.[20]

The optimal policy consists of two phases: the oil phase (0,T) and the past-oil (T,∞). During the oil phase the economy aggregate capital stock , X(t), consists of two kinds of assets: the exhaustible resource earning discounted back to time t, i.e.,

$$(4)\qquad V(t) = \int_{s=t}^{T} P(s)\ E(s)\ e^{-r(s-t)}\, ds,$$

plus the non-resource (reproducible) capital stock K(t). That is:

$$(5)\qquad X(t) = V(t) + K(t)$$

using (3.1) and (3.2) the following expressions for V(t) obtain: for t ≤ 15:

[20] These estimates are based on the World Bank Bahrain CEM Mission's assessment of the oil sector.

$$v(t) = \bar{P}.\bar{E}_{AS}(0) \int_{s=t}^{15} e^{-r(s-t)} ds$$

$$+ \bar{P}\,\bar{E}_B(0)\, e^{rt} \int_{s=t}^{15} e^{-(0.06+r)s}\, ds$$

(4.1)

$$+ \int_{s=15}^{T} \bar{P}.\bar{E}_{AS}(0)\,.\,e^{[15(.06)+rt]}\,.\,e^{-(.06+r)s}\, ds$$

$$= \frac{\bar{P}.\bar{E}_{AS}(0)}{r}\left[1-e^{-(15-t).r}\right]$$

$$+ \frac{\bar{P}.\bar{E}_B(0)\, e^{rt}}{(.06+r)}\left[e^{-(0.06+r)t}-e^{-(.06+r)15}\right]$$

$$+ \frac{\bar{P}.\bar{E}_{AS}(0)\, e^{(rt+0.9)}}{(.06+r)}\left[e^{-(.06+r)15}-e^{-(.06+r)T}\right]$$

For 15 < t < T:

$$v(t) = \int_{s=t}^{T} \bar{P}.\bar{E}_{AS}(0)\,.\,e^{-0.06(s-15)}\,.\,e^{-r(s-t)}\, ds$$

(4.2)

$$= \bar{P}.\bar{E}_{AS}(0)\,.\,e^{(0.9+rt)} \int_{s=t}^{T} e^{(-0.06+r)s}\, ds$$

$$= \frac{\bar{P}.\bar{E}_{AS}(0)\,.\,e^{(0.9+rt)}}{(0.06+r)}\,.\left[e^{-(.06+r)t}-e^{-(0.05+r)T}\right]$$

This phase will be followed by the post-resource era, (T,∞), during which capital stock will accumulate according to:

(6) $$\frac{\dot{K}(t)}{K(t)} = r - \frac{C(t)}{K(t)}$$

By invoking the standard result in the optimal growth theory that in the steady state equilibrium consumption and capital stock should grow at the same rate, we have:

(7) $$\frac{C(t)}{K(t)} = r-\sigma \text{ for } t>T \text{ where } \sigma$$

is the rate of growth of the optimal level of consumption.

Now the corresponding steady state to (6) and (7) during the oil era (0, T) can be manipulated to obtain the following optimal paths for consumption and capital accumulation:

(8) $$C(t) = (r-\sigma)\ [v(0) + K_0]\ e^{\sigma t} \quad 0 \leq t < T$$

(9) $$K(t) = \frac{1}{r-\sigma} C(t) - v(t) \quad 0 \leq t < T$$

From (7) we define the optimal saving rate for the post-oil era, denoted by $Ps^*(t)$:

(10) $$Ps^*(t) = 1 - \frac{C(t)}{rK(t)} = 1 - \frac{r-\sigma}{r} = \frac{\sigma}{r} \text{ for } t > T$$

On the other hand, during the resource life the optimal saving rate as measured conventionally is given by:

(11) $$S^*(t) = 1 - \frac{C(t)}{P(t)E(t) + rK(t)}$$

Note that v(0) can be computed from (4.1) and for t $\neq$ 0 v(t) can be obtained from (4.1) or (4.2) depending on the range of t, which allows us to compute indexes for C(t), K(t) and then the optimum saving rate $S^*(t)$. To study the evolution of $S^*(t)$ over time, let us rewrite the expression for $S^*(t)$ as follows:

(11') $$S*(t) = 1 - \frac{(r-\sigma)A_o}{rA_o + A(t)}$$ where

(12) $$A_o = v(0) + K(0)$$

(13) $$A(t) = e^{-\sigma t}\left[\bar{P}.E(t)-r.v(t)\right]$$

Now it can be shown that

(14) $$\frac{ds^{*}(t)}{dt} = \frac{(r-\sigma)A_o \frac{dA(t)}{dt}}{[rA_o+A(t)]^2},$$ so

the sign $\frac{ds^{*}(t)}{dt}$ follows the sign of $\frac{dA(t)}{dt}$. The derivation of $\frac{dA(t)}{dt}$ should be obtained for each of the two ranges for t. Unfortunately such expressions are rather messy and their signs depends on the relative magnitudes of the parameters involved. However, it is likely that the optimal saving rate will be declining over time,[21] since an approximation of the extraction rate such as:

(15) $$E(t) = \begin{cases} \bar{E}.e^{-.06t} & 0 \le T < T \\ 0 & t \ge T \end{cases}$$

implies

(16)
$$\begin{aligned} v(t) &= \int_{s=t}^{T} \bar{P}.\bar{E}.e^{-.06s}.e^{-r(s-t)}\,ds \\ &= \bar{P}.\bar{E}e^{r.t}\int_{s=t}^{T} e^{-(.06+r)s}\,ds \\ &= \frac{\bar{P}.\bar{E}.e^{rt}}{(.06+r)}.\left[e^{-(.06+r)t}-e^{-(.06+r)T}\right] \end{aligned}$$

Hence,

[21] Actually this is what has happened in the case of the particular assumptions of this paper, see Table (4) of the text.

(17)

$$A(t) = e^{-\sigma t}\left[\bar{P}.\bar{E}.e^{-0.06t} - \frac{r.\bar{P}.\bar{E}.e^{rt}}{(.06+r)}[e^{-(.06+r)t} - e^{-(.06+r)T}]\right]$$

$$= \bar{P}.\bar{E}\left[e^{-(\sigma+.06)t} - \frac{r}{(.06+r)}e^{-(0.06+\sigma)t} + \frac{r}{(.06+r)}e^{-(0.6+r)T}.e^{(r-\sigma)t}\right]$$

therefore,

(18)

$$A'(t) = \bar{P}.\bar{E}\left[-(\sigma+.06)e^{-(\sigma+.06)t} + r.e^{-(0.6+\sigma)t} + \frac{r(r-\sigma)}{(.06+r)}.e^{-(.06+r)T}.e^{(r-\sigma)t}\right.$$

$$= \bar{P}\,\bar{E}\left[-(\sigma+.06-r)e^{-(\sigma+0.6)t} + \frac{r(r-\sigma)}{(.06+r)}e^{(.06+r)T}.e^{(r-\sigma)t}\right]$$

$$\leq -\bar{P}.\bar{E}.(\sigma+.06-r).e^{-(\sigma+0.6)t}\left[1-\frac{e^{(r-\sigma)t}}{e^{(.06+r)T}}\right]$$

< 0, *as long as*

$\sigma \leq r \leq 0.06.$

Also it is clear from (11) and (11') that :

(19) $$\lim_{t\to T-0} s^*(t) \neq \frac{\sigma}{r},$$

where $\frac{\sigma}{r}$ is the optimal saving rate in the post-oil era (equation (10) above).[22] This implies that

our derived optimal saving ratios will have a left discontinuity at t = T, which is consistent with the Figure 3 above.

[22] We are indebted to Mr. Hashimoto for pointing this out to us.

Table (A.1): Bahrain
Selected Macroeconomic and Sectoral Indicators

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
GDP Growth Rate (%)		-6.6	-7.5	8.5	4.9	-2.0	1.6	-1.2	7.3	2.5	1.2
GNP Growth Rate (%)		-2.5	-7.9	8.2	9.9	-6.1	0.8	-9.1	5.7	-7.9	9.5
Sectoral Growth Rates (%)											
Agriculture		8.6	10.3	-1.4	-6.6	-7.8	6.8	2.4	-7.8	-6.7	0.9
Mining & Quarrying		-13.5	-37.4	2.6	12.7	-0.9	5.9	-10.6	2.0	3.3	3.7
Manufacturing		-7.6	6.3	10.8	10.9	-10.5	0.8	1.1	11.7	0.4	5.2
Electricity & Water		9.8	13.1	12.6	10.3	7.6	-16.1	2.8	10.0	26.6	1.6
Construction		-11.4	27.9	32.2	-1.1	13.2	-19.2	-2.7	13.6	-6.1	2.0
Trade, Hotels & Restaurants		3.4	15.0	12.9	-18.4	-21.4	-5.5	13.6	14.7	-0.1	3.5
Transport & Communication		-6.3	17.7	4.4	5.0	-7.8	-12.4	-1.4	11.6	-0.8	-14.6
Finance & Real Estate		23.5	58.5	26.8	-2.1	7.9	-0.9	-18.9	5.9	-19.9	-6.0
Public Administration		-0.6	11.9	5.2	8.3	6.5	14.7	7.5	4.9	2.9	3.6
Others		31.9	84.3	32.0	-6.9	10.2	-5.8	-20.8	4.3	-36.2	-6.9
Sectoral Distribution of GDP (%)											
Agriculture	0.7	0.7	0.8	0.9	0.9	0.8	1.0	0.9	0.8	0.7	0.7
Crude Oil & Natural Gas	34.7	32.9	29.2	24.7	24.0	28.4	19.1	18.7	15.3	17.4	22.0
Manufacturing	16.2	15.5	12.4	11.9	12.4	10.0	13.9	16.0	18.6	17.8	17.2
Electricity & Water	1.0	1.2	1.4	1.6	1.7	1.8	1.7	1.8	1.8	2.1	2.0
Construction	7.0	8.1	9.7	9.8	10.7	9.6	3.6	7.3	7.1	6.5	6.4
Trade, Hotels & Restaurants	11.7	10.7	11.6	12.6	9.7	8.6	9.1	9.9	10.7	10.2	10.1
Transport & Communication	8.7	9.6	11.6	13.1	12.4	11.9	12.3	11.7	11.7	11.3	9.6
Finance & Real Estate	14.2	19.4	25.6	25.4	25.8	22.8	23.0	18.0	18.9	15.8	13.1
Public Administration	11.7	12.0	13.6	14.7	16.4	18.2	21.8	22.8	22.8	22.2	21.4
Others	9.8	14.0	19.5	18.8	18.2	17.2	16.2	13.1	13.9	9.9	8.2
Composition of Output (% GDP)											
Resource Balance	10.0	11.3	11.3	3.5	3.0	5.6	4.1	6.5	9.8	5.3	14.5
Exports of GNFS	122.7	131.5	118.3	95.7	92.1	89.5	79.6	92.1	87.0	92.7	109.6
Imports of GNFS	112.7	120.2	106.9	92.2	89.1	83.9	75.5	85.6	77.2	87.4	95.1
Total Consumption	45.0	47.3	51.5	52.4	54.6	53.9	59.4	58.8	61.8	63.9	61.7
Government	13.0	14.5	17.0	18.1	20.6	22.5	26.1	26.1	26.9	26.5	25.8
Private	32.0	32.8	34.5	34.3	34.0	31.5	33.4	32.7	34.9	37.5	35.9
Gross Domestic Investment	30.8	29.2	33.0	41.0	43.3	35.0	32.6	30.1	27.3	28.6	27.3
Government	13.4	11.2	12.3	15.5	14.5	12.2	11.8	9.6	8.7	8.1	8.5
Private	17.4	18.0	20.6	25.5	28.8	22.8	20.9	20.6	18.6	20.6	18.8
Change in Stocks	14.1	12.3	4.2	3.0	-0.9	5.4	3.8	4.6	1.1	2.1	-3.5
Memo Items:											
GDP (1985 Fixed Prices)	1447.1	1350.9	1249.5	1355.4	1421.8	1392.8	1415.2	1397.8	1500.5	1538.0	1556.9
GNP (1985 Fixed Prices)	1368.4	1334.4	1229.2	1329.8	1461.6	1372.3	1382.8	1256.4	1328.2	1222.8	1339.1
5-Year ICOR						-42.6	38.5	17.2	17.2	19.7	12.3
Population (Millions)	0.334	0.360	0.374	0.391	0.407	0.425	0.442	0.458	0.473	0.489	0.503
Per Capita GNP (BD)	3225	3576	3601	3528	3699	3232	2664	2377	2421	2280	2536

Source: Government of Bahrain.
October 8, 1992

Table A.2: Bahrain
Fiscal and Monetary Indicators

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. Aggregate Indicators:											
Inflation (% Changes in CPI)		11.3	8.9	3.0	0.3	-2.6	-2.3	-1.7	0.3	1.5	0.9
Consumer Price Index	82.0	91.3	99.4	102.4	102.7	100.0	97.7	96.0	96.3	97.7	98.6
GDP Deflator (1985=100)	80.0	96.5	109.7	103.6	103.3	100.0	84.7	85.3	84.2	87.6	94.3
Nominal Deposit Interest Rate (%)	7.9	9.0	8.6	7.0	7.0	6.7	5.6	5.0	5.5	7.3	..
Interest on Public Debt (%)	2.1	3.2	2.3	2.5	2.4	3.3	3.6	3.6	3.1	2.8	2.8
B. Gvt Fiscal Position (% GDP)											
Total Revenue and Grants	38.5	41.2	40.4	34.9	34.8	38.2	35.5	35.8	31.8	32.5	33.9
Oil and Gas Revenue	28.2	30.6	29.4	23.3	24.1	26.9	20.5	20.7	16.6	18.4	20.9
Non-Oil Revenue	5.4	6.1	6.9	8.3	8.1	8.6	11.8	11.9	12.2	11.3	11.2
Grants	4.9	4.5	4.1	3.3	2.6	2.7	3.1	3.2	3.0	2.8	1.8
Total Expenditures	27.4	29.2	34.6	38.1	36.0	35.7	39.8	38.2	38.2	36.8	36.6
Current Expenditures	16.5	17.7	21.8	22.3	21.7	23.9	28.1	28.9	29.9	29.1	28.3
Government Savings	21.9	23.4	18.6	12.6	13.1	14.2	7.4	6.9	1.9	3.4	5.6
Capital Expenditures	10.8	11.5	12.8	15.8	14.3	11.8	11.7	9.3	8.3	7.7	8.3
Surplus or Deficit (-)	11.1	12.0	5.9	-3.2	-1.2	2.4	-4.3	-2.3	-6.4	-4.3	-2.7
Net Extrabudgetary Operations	-5.2	-3.5	-3.5	-3.7	0.7	-1.3	-3.9	-8.7	9.2	-6.5	-6.4
Overall Surplus or Deficit (-)	5.9	8.5	2.3	-6.8	-0.5	1.1	-8.2	-11.0	2.8	-10.8	-9.0
o/w Financing by Domestic Banks	-0.4	-0.4	-4.9	3.8	11.9	-9.9	6.0	8.8	5.0	7.5	-0.6
Consolidated Public Debt (% GDP)	8.4	7.8	8.1	8.4	8.8	7.6	11.4	13.9	20.2	20.3	14.8
Domestic	1.7	1.5	1.5	2.1	2.0	2.2	5.5	8.6	15.3	16.0	11.0
Foreign	6.7	6.2	6.6	6.2	6.7	5.5	5.8	5.3	4.8	4.3	3.8
C. Monetary Aggregates (% GDP)											
Base Money											
M1	16.6	19.1	19.5	17.8	16.3	17.5	19.7	20.7	18.9	17.4	17.6
M2	45.3	56.0	56.9	60.0	56.4	64.9	73.9	81.3	79.8	78.1	63.4
M3	64.3	88.2	83.0	82.7	80.2	92.6	101.9	95.9	99.6	96.4	73.0
D. Balance of Payment (Mln $)											
Resource Balance	308.5	390.2	413.6	132.5	116.2	207.5	131.7	206.6	327.6	190.4	565.4
Net Factor Income	-211.9	-48.5	-60.0	-70.3	103.2	-54.6	-56.7	-276.5	-311.1	-621.2	-509.8
Net Current transfers	-93.4	-106.6	-117.6	-102.1	-125.5	-234.8	-264.6	-243.6	-193.1	198.9	-272.3
Current Account Balance (with Official Grants)	184.4	429.5	425.6	102.7	218.4	38.3	-68.9	-200.2	189.9	-129.8	242.1
Capital Account	-237.7	-503.0	-71.1	-166.0	-35.7	-397.9	-73.7	-53.7	223.7	211.0	-400.0
Errors & Omissions	396.3	662.7	-358.9	-45.2	-193.1	629.5	-35.6	-89.1	133.0	121.5	-194.7
Gross Reserves (Excl. Gold)	953.4	1544.1	1534.8	1426.4	1302.4	1659.7	1489.4	1148.5	1251.7	1050.0	1234.9

Source: Government of Bahrain.
October 8, 1992

Table (A.3): BAHRAIN
Real Exchange Rate and its Fundamentals

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Real Effective Exchange Rate														
Real Effective Exchange Rate	94.6	91.2	89.6	78.2	86.5	96.9	100.5	102.8	100.0	81.4	70.4	64.6	65.4	60.1
Nominal Effective Exchange Rate	72.0	73.5	72.5	72.9	79.4	87.1	91.3	96.8	100.0	85.0	76.6	72.3	75.3	72.1
Fundamentals														
Terms of Trade (1985=100): Oil vs Non-Oil Imports	61.5	52.9	70.1	110.2	119.6	124.8	106.6	100.6	100.0	58.3	67.2	60.1	68.1	86.8
Government Consumption as Precentage of GDP (%)	14.4	14.6	14.9	13.0	14.5	17.0	18.1	20.6	22.5	26.1	26.1	26.9	26.5	25.8
Resource Balance as Precentage of GDP (%)	0.6	0.8	15.1	10.0	11.3	11.3	3.5	3.0	5.6	4.1	6.5	9.8	5.3	14.5

Sources: Government of Bahrain, IFS Statistics, and staff estimates.
March 8, 1993

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