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Bahrain's Economy and Total Factor Productivity

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Background*

The State of Bahrain was the first producer of oil in the Arabian Gulf region. But it was not until the quadrupling of oil prices between October 1973 and January 1974 - as a result of the action by OPEC members to raise the price of oil - that substantial financial capital became available and provided the potential for rapid economic development [1]. Bahrain's oil revenue rose in real terms (constant prices of 1980) from 71.7 million Bahraini Dinars (BD) in 1973 to BD 391.4 million in 1981[2]. The government enjoyed a virtual five - fold increase in its revenues over the period 1973 - 1981.

The share of oil revenues in total public revenues increased from 65 percent in 1973 to a peak of 85 percent in 1974, but then decreased to 70 percent in the early 1980s, and then decreased further to about 60 percent in the second half of 1980s and early 1990s [3]. However, oil revenues remain highly significant in the Bahrain economy.

A large part of the oil earnings were made available to the government, increasing substantially its financial resources. These were used by the Bahraini public administration to launch an ambitious investment program to provide the economy with a supporting

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physical infrastructure and to embark upon industrialisation through joint ventures with regional and international investors.

This era of a booming economy coincided with a number of measures to encourage private foreign investment. As a result, the banking offshore industry expanded rapidly, and by 1980 Bahrain had become an important financial center in the region. The acceleration of investment spending and the continuous growth of various economic sectors also led to a rapid inflow of foreign labour, which comprised more than half of the labour force by 1981.

Like most of the Gulf countries, Bahrain's economy has fluctuated along with oil price. The collapse of the oil price in the mid 1980s caused GDP to contract, with negative real GDP growth of -2.8% in 1985, and growth rates in the following two years of around 1.2% in 1986 and 1.9% in 1987. However, with the end of the Iran-Iraq war in 1988 Bahrain's economic prospects were revived. From 1988 onward there was a recovery with positive real GDP growth of around 5.5% in the five years to 1993.

This paper provides an overview of the Bahrain economy since 1980. It is intended to examine the dimensions of economic growth, the issues of investment efficiency, labour productivity and extent of total factor productivity. Also, the paper attempts to quantify the sources of growth over the period understudy (1980-1993). The final section summarizes the main findings of the paper.

1.Analytical framework:

1.1Total factor productivity

It is clear that the growth of productivity is key to long - term economic growth. Productivity is often expressed as a ratio of output to inputs. There are as many indices of productivity as there are inputs of production, but the best known are the productivity indices of labour and capital, and the total factor productivity indices. Total factor productivity (TFP) is often known as the "residual" or the index of "technical progress". The total factor productivity indices most often used in empirical research are Kendrick's arithmetic index and Solow's geometric index. However, The total factor productivity measurement in both the sectoral and the aggregate economy depends directly on the concept of production function. The general aggregate form of this, given constant returns to scale and the marginal theory of distribution, can be written as:

$$Y = A(t)\, F(K, L) \qquad (1)$$

Where: Y is the net real output produced; K, L are the capital and labour input; t allows the function to change over time; A (t) represents the Hicksian efficiency parameter and measures the cumulative effects of shifts over time, that is, all efforts that go into the determination of Y in addition to capital and labour. (4).
Taking the total differential of (1) and dividing by Y gives:

$$\dot{Y}/Y = \dot{A}/A + \alpha_k \dot{K}/K + \alpha_L \dot{L}/L \qquad (2)$$

Where $\dot{Y} = dY$, $\dot{A} = dA$, $\dot{K} = dK$ **and** $\dot{L} = dL$

Furthermore, we are able to define:

$$\alpha_k = \partial Y/\partial K * K/Y \quad \textbf{and} \quad \alpha_L = \partial Y/\partial L * L/Y \qquad (3)$$

As output elasticities of capital and labour respectively. The term $(\dot{A}/A)$ represents the shift in the production function and the expression $[\alpha_k \dot{K}/K + \alpha_L \dot{L}/L]$ indicates a movement along the function. Equation (2) shows that growth in real output consists of three components:

(1) The contribution of capital accumulation,
(2) The contribution of growth in employment.
(3) The growth in total factor productivity

By assuming that factor markets are in competitive equilibrium, so that capital and labour are paid their marginal products, the output elasticity of each factor becomes its share in total output, that is:

$$\alpha_k = rK/Y \quad \textbf{and} \quad \alpha_L = wL/Y \qquad (4)$$

Where r and w are the prices of capital and labour respectively. From (2) the growth in technical progress or total factor productivity can be measured as the difference between the growth in aggregate output and the contribution of the growth in total factor inputs:

$$\dot{A}/A = \dot{Y}/Y - \alpha_k \dot{K}/K - \alpha_L \dot{L}/L \qquad (5)$$

Assuming constant returns to scale, so that

$$\alpha_K + \alpha_L = 1 \qquad \textbf{Or} \qquad \alpha_K = 1 - \alpha_L$$

and (5) can be written as:

$$\dot{A}/\dot{A} = y/y - \alpha_k \dot{k}/k \qquad (6)$$

Where: $y = Y/L$ **and** $k = K/L$

Using equation (6) and with time series data on output per man- hour, capital per man-hour and the share of property in income ($\alpha_k = rK/Y$), Solow was able to estimate ($\dot{A}/A$) for each year of the period 1909- 1949. By treating $\dot{A}$ (t)= A (t) – A (t-1), setting A (1909) = 100, and using the fact that:

$$A(t) = A(t-1)\,(1+\dot{A}(t)/A(t-1)) \qquad (7)$$

Solow produced an index of total factor productivity.

Solow found that total factor productivity was growing at the rate of 1.5 percent per year from 1909 to 1949 and that 90 percent of the total rise in output per man-hour during the forty-year period was the result of technical progress (i.e. of shifts in the production function), and only the remaining 10 percent resulted from increases in capital per man-hour (movement along the production

function). It is important to point out here that Solow himself acknowledged that the large proportion of technical progress in his calculation was not just the result of disembodied neutral technical progress but also of increasing returns to scale, redistributive effects as factor inputs shift to more productive sectors and an embodied type of technical change caused by improvements in the quality of capital and in the education of labour force.[5] Furthermore, Solow's basic equation form (1957) has also been used as a growth accounting measure to estimate the sources of growth in the neoclassical approach [6] . In fact, the traditions of total factor productivity measurement and growth " accounting " came together in the work of Solow [7] .

Edward Denison applied the neoclassical growth approach on a very detailed basis, and gave rise to growth accounting. One major result of his study is that education in the United States during the 1930-1960 period accounted for as much as 23 percent of the annual growth rate, more than any other single source of growth such as capital accumulation, except the increase of the labour force itself. [8]

Griliches and Jorgenson (1966) have taken Denison one step further by arguing that technical progress can be explained properly by adjusting inputs and outputs to take account of measurement errors in their prices and quantities and also their aggregation. [9] As a result of this, the residual is negligible in their approach. In other words, they argued that virtually the whole of the growth

of output can be explained by movement along a linearly homogeneous aggregate production function. Chen (1979) found that their research seemed to suggest that the study of technical change in economic growth is meaningless as technical change is due almost entirely to mis-measurement and therefore does not in fact exist. [10] However, one can argue that many of the adjustments made to reduce the contribution of the residual are likely to be related to what is called technical progress.

Kendrick (1980), Madison (1982) and others have shown that the growth accounting of Denison significantly underestimated the contribution of capital to growth. [11] In other words, the growth in capital would be understated by Denison if it is the vehicle for the embodiment of new technology in production. Fischer (1987) argues that the embodiment hypothesis would explain the positive cross-sectional relationship between the growth rate of GNP and the share of investment in GDP for a sample of economies under the study period, 1965-1984. [12] Also, he shows that the relationship is particularly strong for developed economies.

Furthermore, the recent trend has drawn attention back to the importance of capital accumulation. The new growth theories have suggested that capital has a higher return where it is already abundant. The original suggestion of Romer (1986) was that there was strong learning - by-doing externality to capital. Hence, increasing rates of growth are more consistent with increasing rather than constant returns. [13] Lucas (1988), Becker, Murphy, and

Tamur (1990), Kremer (1993) and others have stressed human capital.[14] In fact, capital can be redefined to include both physical and human capital. [15]

Summing up, one can argue that all the earlier results on the sources of growth in developed countries tended to indicate that a relatively small proportion of growth can be accounted for the increase in capital and labour, which leaves a large residual. On the other hand, contrasting pattern of findings has emerged from empirical studies on the experience of growth in developing countries. Bruton (1967) in a study of five Latin American countries, indicated that total factor productivity growth was lower than in the developed countries.[16] Madison (1970) and Nadiri (1970) reached a similar conclusion.[17] Chenery (1986) reported the value of the total factor productivity for thirty nine countries. The developed countries showed little growth of labour input (1.1 percent), moderate growth of capital (5.2 percent) and a relatively high contribution of total factor productivity to aggregate growth (50 percent). The developing countries showed a high growth of labour input (3.3 percent), a high growth of capital (4.3 percent) and a relatively small contribution of total factor productivity to aggregate growth (31 percent).[18]

Young (1994) reported a negative total factor productivity growth rate for Singapore and a moderate total factor productivity growth rate for Hong Kong, South Korea, and Taiwan over the period 1966-1990. As a result, the high growth rates of real GDP for the four East Asian

economies reflect high contributions from the growth of capital and labour inputs, and not extraordinary improvements in total factor productivity.[19]

1.2 Measuring Capital Stock

Since the economy's capital stock determines in large part the national production capacity, the study calls for a time series on capital stock. Official capital stock series are not available for Bahrain Official investment and depreciation series, however, are available. So, these data were used to generate capital stock series for the period 1980-1995, using the methodology of Irma Adelman and Hollis B.Chenery (1960) in their study of the economic development of Greece. [20] In the absence of direct information on capital stock, such a procedure is commonly used in developing countries.[21]

The first stage to generate a capital stock series is to estimate the incremental capital-output ratio (ICOR) for the period understudy using the following formula:

$$\mathbf{ICOR = NI\ (t)/Y\ (n)-Y\ (0)} \qquad \mathbf{(8)}$$

Where **NI (t) = net capital formation (investment) at time t.**
Y (n) = gross domestic product at time n (the last year of the sample period).
Y (0) = gross domestic product at time 0 (the first year of the sample period)

The major assumption is that the ICOR measure is equal to an average capital-output ratio over the sample period. In the second stage, the value of capital stock for the first year of the period under study is estimated by multiplying the overall ICOR by the GDP for that year as follows:

$$K(0) = ICOR * Y(o) \qquad (9)$$

The values of capital stock for the rest of the study period can be obtained by accumulating net capital formation, i.e.

$$K(t) = K(t-1) + NI(t-1) \qquad (10)$$

Where **K (t-1) is capital stock in year (t-1).**

Several researchers have used this measure of capital stock to estimate an index of technical progress or total factor productivity. However they did not pay attention to the limitation of this approach. Thus, we attempt here to shed some light on this method and its limitation.

The main underlying assumption of this approach is that the ICOR measure is equal to an average capital-output ratio. The only way this can occur is for the capital–output ratio to remain constant. So, if (K) represents capital and (Y) output, then the output elasticity of capital (α_k) can be written as:

$$\alpha_K = dY/dK * K/Y \qquad (11A)$$

Or

$$K/Y = \alpha_k \, dK/dY \qquad (11B)$$

By assuming labour and technology constant, and (α_k) less than unity, then an average capital-output ratio must be smaller than the marginal capital-output ratio. Over time, however, the change in (Y) is caused by the change in capital (K), labour (L) and technology (A), that is

$$\mathbf{dY/Y = \alpha_L\, dL/L + \alpha_K\, dK/K + A} \qquad \mathbf{(12)}$$

Where α_L, α_k and A refer to output elasticities of Labour, capital, and technology respectively. Multiplying equation (12) by K/dY we get:

$$\mathbf{K/Y = [\alpha_L\,(dL/L) + A](K/dY) + \alpha_k\,(dK/dY)} \qquad \mathbf{(13)}$$

$$\mathbf{= [\alpha_K + (A + \alpha_L\,(dL/L))\,/\,(dK/K)](dK/dY)}$$

Therefore, K/Y= dK/dY can take place only if the first component in the right hand side of equation (13) is equal to unity or:

$$\mathbf{A = (1-\alpha_k)(dK/K) - \alpha_L\,(dL/L)} \qquad \mathbf{(14A)}$$

Or

$$\mathbf{A = (1-\alpha_k)(dK/K - dL/L)} \qquad \mathbf{(14B)}$$

Where ($\alpha_L+\alpha_k=1$). Thus, technical progress must exactly offset diminishing returns to capital ($\alpha_k<1$) associated with an increase in the capital- labour ratio.

Summing up, we can argue that the above approach is based on either of the following two assumptions:

(a) A constant capital-labour ratio and constant technology or

(b) Technical progress is always exactly the right amount to offset diminishing returns to capital associated with an increase in the capital-labour ratio.

Furthermore, under these assumptions we do not need a measure of capital to calculate technical progress. When the incremental capital-output ratio is equal to the average capital - output ratio, the growth rate of capital is equal to the growth rate of output. Assuming constant returns to scale ($\alpha_L + \alpha_k = 1$), technical progress is equal to the growth rate of output per worker times the output elasticity of labour, that is: [22]

$$A = \alpha_L (dY/Y - dL/L) \qquad (15)$$

2. Investment and Productivity:

A conventional view is that the growth rate of an economy is a function of the investment to GDP ratio and the productivity of that investment. As a consequence, it is common among empirical researchers to apply the Harrod-Domar relationship to get some indication of the productivity of investment.

The underlying assumption of this relationship is that the output of an economy depends on the amount of capital invested in that economy. So, if we assume output (Y) and capital stock (K), then the relationship between output and capital stock can be:

$$Y=K/V \qquad (16)$$

Where (V) is a constant called the capital-output ratio. Introducing increases in output and capital and dividing both sides of the equation by (Y) we get:

$$G = \Delta Y/Y = \Delta K/Y * I/V \qquad (17)$$

Where Δ Y/Y is the growth rate of output (g) and Δ k is the same as investment.

Thus, the rate of economic growth is a function of the ratio of investment to GDP and the productivity of investment, defined as the inverse of the capital-output ratio. Furthermore, the incremental capital - output ratio can provide a useful, though partial, indicator of investment efficiency. Thus, improving the productivity of investment is very closely related to a reduction in the incremental capital-output ratio for the whole economy. The ratio for the whole economy, however, is composed of such ratios for the individual sectors and subsectors. Furthermore, any economy comprises sectors which by virtue of their inherent nature and the country's resource endowment have high, medium or low incremental capital-output ratio. Therefore, the larger the share of investment in sectors with a high incremental capital-

output ratio in total investment, the higher the incremental capital-output ratio for the economy as a whole, which means low productivity of investment.

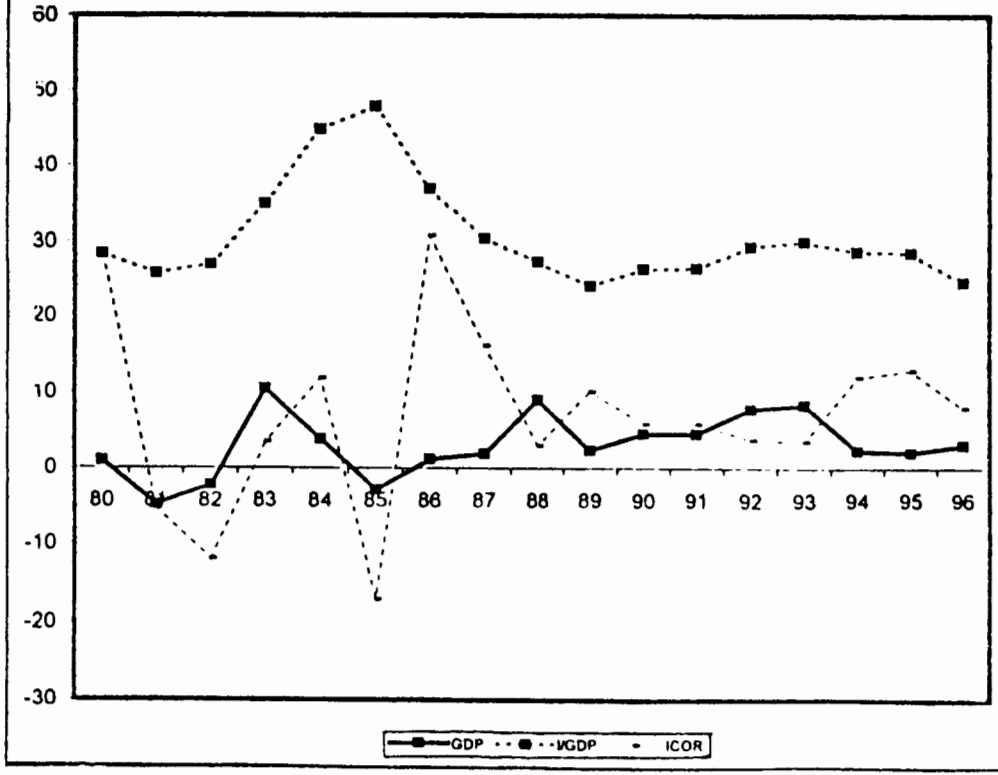
Turning to the situation in Bahrain, figure (1) shows the growth rate of GDP, gross investment in GDP, and the realized incremental capital - output ratio (ICOR). As would be expected, the ICORS were very low during the years of high growth rates of GDP. For instance, during the years of 1983, 1988, and 1993 gross investment in GDP and GDP growth ratio in Bahrain were relatively high while their ICORs were low.

However, slower economic growth years but continuing high investment in GDP resulted in a sharp rise in the ICORs. For instance, the period from 1984 to 1987 can be regarded as the period of " high cost economy".

In the early 1990s ICOR began to decline. However, the mid 1990s has shown slower economic growth and lower investment in GDP and rising ICOR.

In summary, one can notice that the ICOR ratio was low in the early 1980s and rose in the mid 1980s. However it fell in the early 1990s but started to rise again in the mid 1990s. The high ratio of ICOR in the current years indicates that serious problems of inefficiency remain which calls for further policy reform.

FIGURE (1) : GDP , Investment , and ICOR , 1980-1996



4. Labour Productivity

The conventional view is that productivity, by definition, is measured as output per worker and when we talk about productivity in an economy as a whole, we are talking about real GDP per worker employed in that economy. As a result of this, it is common to decompose economic growth into two parts: growth of employment and the change in labour productivity. In fact, when an economy is close to its maximum sustainable level of employment and capacity utilization, further economic growth will have to come from increases either in productivity - that is output per worker - or in the volume of the potential workforce. Hence, the analysis of output change can take the following form:

$$\Delta Y = \Delta L\, \bar{y} + \Delta y\, \bar{L} \qquad (18)$$

Where:

$y = Y/L$ represents labour productivity

$$\Delta y = Y(1)/L(1) - Y(0)/L(0), \qquad \Delta L = (L(1) - L(0)),$$

$$\bar{y} = [Y(0)/L(0) + Y(1)/L(1)]/2, \qquad \bar{L} = (L(0) + L(1))/2.$$

Hence, the change is calculated between two periods. The variables $\bar{y}$ and $\bar{L}$ represent the average values of y and L across the two periods. [23]

The first component on the right hand side of equation (18) represents the effect on output of the change of employment (L(1)-L(0)) assuming that the productivity of

labour is constant. However, this is different from the growth of output that would have resulted from the growth of employment, assuming all other factors associated with a proportionate growth of capital. Thus, this component represents the joint effect of the growth of employment and the associated growth of capital. The rapid growth of employment, particularly foreign labour, can be explained partly by the increase in oil revenues which led to higher levels of investment. Furthermore, a large part of the growth of employment in the Bahrain economy is due to the increase in demand for goods and services, especially in construction, finance and trade, and communication sectors.

The second component on the right hand side of equation (18) represents the effect on output of the change of labour productivity assuming employment is constant. The growth of labour productivity is usually decomposed into two parts. Part of the increase in labour productivity is due to increases in capital per worker. The other part is attributed to improvements in organization, skills and so on. However, it is difficult to separate these two parts. Thus, as most of the rise in labour productivity is accompanied with an increase in capital per worker, we can assume that there is a strong relationship between the entire growth of labour productivity and the increase in capital per worker.

Table (1) shows that the change in the first period 1980 - 1984 was due to the first component and the contribution of the second component was negative. Over the second

period 1985 - 1989, the first component contributed 53%, while the second component contributed 47%. However, over the third period 1989 -1993 the change was due to the employment change effect and the contribution of the productivity change was negligible. Furthermore, the analysis of the change over the whole period 1981 - 1991 shows that the change of GDP was due to employment change while the contribution of the productivity change was negative.

Table (2) reports the employment change effect and the productivity change effect for the economic sectors in the Bahraini economy over the period 1981-1991. The change in GDP was BD. 407.7 million over the study period. The most important sector in generating this GDP change was the financial and real estate sector through the employment change effect. However, if change had not grown in that sector, aggregate employment change effect would have been lower by BD. 338.4 million or 83% of the total change effect. In other words, without employment growth in the financial and real estate, GDP growth would have been very small. Furthermore, the shift in employment for the Bahraini economy was away from mining and construction and toward financial and real estate, manufacturing, community and social personal services, and trade, hotels, and restaurant sectors, which had lower productivity. Productivity effects though were also important. Shifting sectoral decomposition reduced productivity change effect of BD.-149.9 million or -36.8% of the total change effect. The shift in productivity was mainly towards transport

and communication, and construction sectors. Indeed, the shift in productivity toward social overheads in the study period reflects the priority of government capital expenditure towards electricity, water, and communication, and it remains a major concern for the Bahrain government today. For instance, over the period (1970 - 1985) the capital expenditure on electricity, water, and communication was estimated to be about 49 percent of total public investment [24]. On the other hand, manufacturing which used to be a potential sector for productivity growth in developed and new industrialising countries registered negative productivity change effect. Thus, one can argue that the change in manufacturing value added during the 1981-1991 period has been due to labour intensive industries.

Table 1: Sources of output change (1980 - 1993)
(BD million in 1989 constant Prices).

Period	Employment change effect	Labour productivity Change effect	Total change effect
1980 - 1984	320.4	-244.3	76.1
1985 - 1989	96.2	84.4	180.6
1989 - 1993	378.3	1.7	380
1981 - 1991	557.6	-149. 9	407.7

Source : Author's Calculations.

Table 2 : Sources of output change (1981 - 1991)
(BD. Million at 1989 prices)

Sector	Employment Change Effect	%	Productivity Change Effect	%	Total Change Effect	%
I. Primary						
1. Agriculture & fisheries	4.894	1.2	-4.894	-1.2	0	0
2. Mining	-74.823	-18.4	-34.077	-8.4	-108.9	-26.7
II. Manufacturing						
3. Manufacturing	190.7	46.8	-102.5	-25.1	88.2	21.6
III. Social overhead						
4. Construction	-6.174	-1.5	41.574	10.2	35.4	8.7
5. Electricity & water	0.398	0.1	11.602	2.8	12	2.9
6.Transport & communication & storage	6.561	1.6	62.439	15.3	69	16.9
IV. Services						
7.Trade & Hotel & Restaurant	72.971	17.9	-41.471	-10.2	31.5	7.7
8.financial & Real Estate	338.414	83.0	-248.314	-60.9	90.1	22.1
9.community & Social Personal service	163.366	40.1	23.434	5.7	186.8	45.8
GDP	557.553	136.8	-149.853	-36.8	407.7	100

Note: columns do not sum because of excluding activities such as "not adequately defined" from employment data, "Imported service charges" from GDP, and also because of rounding.

Source : Author's Calculations.

5.The Bahrain Total Factor Productivity : Solow's Measure

The standard approach to analyzing the total factor productivity is through the growth accounting approach which takes the following form:

$$GY = \alpha_k \, Gk + \alpha_L \, GL + GA \qquad (19)$$

Where: G is the rate of growth of the variables output (Y), Capital (K) and labour (L), α_k and α_L are the output elasticties of capital and labour respectively. According to this approach, the growth of output is decomposed into three components: the effect of the growth of labour, the effect of the growth of capital, and the effect of technological progress.

The main problem with this approach is the calculation of factor elasticties of output. Some economic researchers obtained elasticities by estimating a Cobb-Douglas production function [25]. But the residuals from the regression analysis are conceptually quite different from the residual in the standard approach to sources of growth. Regression residuals always sum to zero ($\sum ei=0$). Thus, this brings into question the unqualified use of estimated factor elasticities of output as factor shares in the standard approach (Solow- Denison) to sources of growth.

Another approach is through the assumption that the economy is in competitive equilibrium, that is, factors of production (capital and labour) are paid their marginal

products. Thus, output elasticities become equivalent to the income shares of the respective factors of production in total income. In the calculation of sources of growth in the economy, we use equation (19) in which labour share (wages and salaries) in value added are used as equivalent to the output elasticity of labour. Assuming constant returns to scale ($\alpha_K + \alpha_L = 1$), we calculate the capital share in value added to be one minus the labour share ($\alpha_K = 1 - \alpha_L$).

The sources of growth of value added for the economy as a whole are presented in table (3). Over the entire period 1983-1993 total factor productivity accounted for a small proportion (17.5 percent) of the growth of GDP. On the other hand, the growth of total factor inputs accounted for most of the GDP growth (82.5 percent). The composition of total factor inputs (TFI) indicates that labour contribution to GDP growth is higher than the contribution of capital, although the weight used in calculating the percentage contribution of labour to GDP growth is lower than for capital. Furthermore, the data show the fluctuation of total factor productivity from a negative contribution in the first sub-period to a positive contribution in the second and third, and that a lower positive contribution in the whole period was accompanied by a large decrease and then large increase in labour growth.

To sum up, our growth accounting exercise applied to the Bahraini economy as a whole has revealed that the sources of growth pattern over the whole period is

explained by the contribution of factors to GDP growth. However, the application of the growth accounting method over the sub-periods has not revealed any consistent pattern and the calculated data should be carefully interpreted.

Table (3) : Sources of Growth for the Bahraini Economy, 1980-1993*

	1980-1984	1985-1989	1989-1993	1983-1993
Length	**4**	**4**	**4**	**10**
GDP Growth (%)	**1.6**	**3.6**	**6.3**	**4.0**
Labour Growth (%)	**6.9**	**1.9**	**6.3**	**4.1**
Capital Growth (%)	**4.8**	**1.6**	**3.0**	**2.7**
Share of labour in GDP (α)	**0.470**	**0.492**	**0.439**	**0.462**
Labour input	**3.243**	**0.935**	**2.766**	**1.894**
Capital input	**2.544**	**0.813**	**1.683**	**1.453**
Total factor inputs (TFI)	**5.8**	**1.7**	**4.4**	**3.3**
Total factor productivity (TFP)	**-4.2**	**1.9**	**1.9**	**0.7**

* GDP series at constant prices of 1989 are obtained from various issues of official national accounts, the capital stock series are derived as discussed in section 1.2, and the time series of the labour force estimates are obtained from various issues of the Statistics Abstract Published by the Central Statistics Organisation .

Conclusion

The supply analysis of ecor.omic growth of Bahrain shows that increases in oil revenues led to a rise in investment which in turn resulted in an increase in the volume of capital stock in the economy. The efficiency of investment as shown by the behavior of incremental capital-output ratio has fluctuated. As would be expected, the ICORS were very low during the years of high growth rates of GDP, that is, in 1983, 1988 and 1993, indicating higher efficiency of investment. However, the high ratio of ICOR in the mid 1990s indicates that a serious problem of investment inefficiency remains which calls for further policy reforms.

By the same token, the increase in financial resources after 1973/1974 led to a rapid inflow of foreign labour, which comprised more than the half of the labour force by 1981 and the ratio remains up to the current time. Our results of the decomposition of GDP growth into the growth of labour force and labour productivity show that growth of employment provided a significant contribution to overall growth. On the other hand, the labour productivity change effect was negative over the whole period 1981-1991. Furthermore, the sectoral decomposition over the period under study 1981-1991, shows that the most important sectors in generating GDP change was the financial and real estate sector through the employment change effect. In addition, the shift in productivity was toward social overhead sectors

reflecting the top priority of government's capital expenditure. On the other hand, manufacturing has shown a negative productivity change effect which reflects the increasing importance of labour-intensive industries in the 1980s.

Furthermore, the application of Solow's measure to the Bahraini economy as a whole shows that the sources of growth pattern over the 1983-1993 period is explained by the contribution of total factor inputs to GDP growth. In fact, empirical studies on the experience of developing countries show that the major source of growth in developing countries is the growth of factor inputs and that the growth of total factor productivity is of less importance as an explanation of growth in developing countries compared to developed countries.[25]

Footnotes

1. Bahrain was one of the focal points for pearling and its related industries in the Gulf region prior to the discovery of oil. Its pearls were the best in the region, and pearling employed half of the male working population. It was also an important agriculture and trading Centre. With the discovery of oil in 1932, Bahrain became the first state on the Arab side of the Gulf to exploit its hydrocarbon resources. See Samar K Datta and Jeffery B. Nugent "Bahrain's Pearling Industry" in Jeffery B. Nugent and Theodore H. Thomas, Bahrain And The Gulf, Groom Helm Ltd, U.K. pp.25-55.

2. The deflator used is the unit value of imports by major petroleum importers. Handbook of the International Trade and Development Statistics, UN Conference on Trade and Development, 1986 (supplement) p.43 cited in Abdulla Al Sadiq, Joint Ventures and Industrialisation in Bahrain, unpublished Ph.D., Lancaster University, 1990,p.1.
3. Statistical Abstract,Various issues, General Statistics Organisation, State of Bahrain
4. Productivity change can also be labour saving or capital saving. There are three definitions of productivity or technical change: (1) Hicksian, which measures bias along a constant capital-labour ratio; (2) Harrodian, which measures bias along a constant capital-output ratio; (3) Solow's which measures bias along a constant labour-output ratio. See David F. Heathfield and Soren wibe, An Introduction to Cost and Production Function, Macmillan, London, 1987, pp 120 - 122.
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23. Equation (18) is the average of the following two equations:

Y(1) - Y(0) = Y(0) / L(0) [L(1) - L(0)] + L(1) [Y(1) / L(1) - Y(0)/L(0)]

and

Y(1)-Y(0) = Y(1) / L(1) [L(1) - L(0)] + L(0) [Y(1) / L(1) - Y(0) / L(0)]

24. Abdulla M.AL Sadiq, Joint Ventures and Industrialistion in Bahrain, unpublished Ph.D., Lancaster University, 1990, PP.49 - 50.
25. For example, Chen (1979) has used the estimated output elasticity of capital for the economy as a whole of both Korea and Taiwan obtained from a Cobb-Douglas estimation, as capital share in income in the calculation of the standard approach of sources of growth in these countries. See

Edward K., Chen (1979) Hyper-Growth in Asian Economies: A Comparative Study of Hong Kong, Japan, Korea, Singapore and Taiwan, Macmilan, London - U.K.

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