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BAHRAIN HEALTH SERVICES: OUTPUT AND PRODUCTIVITY GROWTH

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Abstract: *The paper investigates the variations in output and multifactor productivity (MFP) growth rates over time in Bahrain health services sector (BHSS) using the recent advances in growth accounting modeling of productivity measurement. The MFP growth rate is a composite measure of the overall economic performance. Results obtained in the paper indicate that high growth rates of output of the BHSS in recent years were possible by increasing the growth of the MFP.*

Keywords: *Bahrain; Economic Growth; Health Care; Multifactor Productivity*

JEL Classification Codes: *O40; O41; I10; I18*

1. INTRODUCTION

Bahrain – a small oil-exporting country – has recently launched *Bahrain Economic Vision 2030* which is a comprehensive economic vision in providing a clear direction for the sustainable economic development of Bahrain. In line of the vision, Bahrain has started to reform some of its vital sectors including the Bahrain Health Services Sector (BHSS). The BHSS along with the banking and finance services sector play the most important role in development and growth of the non-oil GDP of Bahrain. A reform for the BHSS has already been initiated in 2008. However, for the reform a true and clear measure of the economic performance of the BHSS in terms of the output and productivity growth rates over the most recent years is needed. Thus, the main objective of this study is to provide estimates of the output and productivity growth rate in the Bahrain health services sector using the national account.As such the study would benefit the policy makers not only in the health sectors but also other sectors in determining the efficient use of the limited resources. This may also help to measure the intra-industry efficiency and the regional integration of the Gulf Cooperation Council countries.

In addition to the national interest to this vital sector in the efficient allocation of resources and providing the best possible services which necessarily requires a sustainable output and the productivity growth in this sector, international health

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agencies are also interested in health services output and productivity growth and its improvement for cross countries comparisons. Inputs including labor, capital and intermediate materials (goods), and services in the health care sector are other economic activities that need to be addressed. In health care, a number of procedures need to be performed using a combination of these inputs. Thus, the output of the health services sector is the combination of such activities which produce the final product (a completed treatment). On the other hand, the outcome of the health care sector is the improved health and overall wellbeing of a person.

Thus, measuring and analyzing the growth rates of productivity and its contribution to the growth of the BHSS output would not be a straightforward task given that there is no prior study regarding the BHSS. On the other hand, there is an extensive and controversial literature on the subject worldwide[see, for example, Kitchen (1997) and Collins *et al.* (1999)]. In this study, we try to answer some of the policy-related questions such as: What is the output growth rate of BHSS in the recent years? What is the growth rate of multifactor productivity (defined as the difference between the output growth and weighted average growth of all inputs)of BHSS over recent years? What is the contribution of the multifactor productivity (MFP) to the output growth in BHSS? Finally, to what extent are the Bahrain health services (BHSS) improving in terms of output and MFP over the last few years? Accordingly, this paper estimates and analyzes the variations in multifactor productivity growth over time in the BHSS using the recent advances in growth accounting modeling of productivity measurement.

This study is not concerned the manner in which health services are conveyed; it focuses purely on the measurement of the output and productivity growth rates in the health services sector given the national accounts of Bahrain. Thus, the measured trend of the output and productivity in Bahrain health services sector as being a real phenomenon given the national accounts data.[1]Even though, this study is limited to examining output and MFP growth rates in Bahrain health services sector, it represents a well-timed and important contribution to more general discussions surrounding the economic performance of this vital sector in Bahrain and possibility of the reform of the existing health system.

2. BAHRAIN HEALTH SERVICE SECTOR: AN OVERVIEW

Bahrain health services are provided by the government and fast growing private health sector. Excluding the newly opened state-of-the-art King Hamad Hospital (data not available), the four government-operated hospitals (including a psychiatric hospital and a geriatric hospital) and 23 health centers had total beds of 1,726 in 2008. There are13 private hospitals with total beds of 378.

Bahrain has adapted a free national health services in 1961which means all Bahrain citizens receive free health care services. This generous policy has reflected

in the country's birth and life expectancy rates. For example, in 2008 the crude birth rate was 15.3 per 1,000 people and the mean of life expectancy at birth was 74.8 years. The general guiding principles of health services reform have stressed that every Bahrain citizen should be entitled to the highest possible quality of the available health care regardless of his/her origin,gender, color, social status, and ability to pay. However, foreigners are eligible to receive state health care with a minimum fee of about $8 per visit through a system of primary health care centers.

Data in 2008 indicate that Bahrain had 2 nurses per physician including dentist in the public health services whereas it had little more than one nurse per physician in the private sector. There were about 18 physicians and 45 nurses per 1,000 in-patients in the year 2008 in comparison of 15 physicians and about 37 nurses per 1,000 in-patients in the year 2005. This may show an improvement in the level of health services provided per in-patient. However, Bahrain is still facing a severe shortage of doctors in government health services because the doctor (including dentists) to patient ratio was 1 to 2890 in 2008 when the same ratio for developed countries was 1 to 600. This meant that the government health services sector needs to increase the numbers of its doctors up to five times of the current number.

Table 1 shows the number of beds and in-/out-patients benefited from Bahrain health services sector (public and private) during 2005 to 2008 (the latest data available).One can see from Table 1 that the number of beds available in the public health services over the time period of 2005 – 2008 did not change much (1.8%) whereas the number of public in-patients had grown by an average annual rate of 9.6% over the same time period. No doubt, there is a need for significant increase in terms of beds and healthcare units in Bahrain public health services sector. On the other hand, the number of beds in private health services providers has increased by an average annual rate of 57% over the time period 2005 – 2008 while the number of in-patients (private) has grown by an average annual rate of about 66% over the same time period.

Table 1
Patients and Beds by Health Services Provider 2004 – 2008

Group/Year	*2005*	*2006*	*2007*	*2008*
In-Patients	98261	96940	98245	98170
- Government	84167	81360	80219	77182
- Private	14094	15580	18026	20988
Out-Patients	4446	4761	5036	5224
- Government	3936	4167	4349	4391
- Private	510	594	687	833
Beds 2033	2037	2043	2104	
- Government	1741	1714	1714	1726
- Private	292	323	329	378

3. GROWTH ACCOUNTING: PRODUCTIVITY MEASUREMENTMODEL

Productivity can be measured as output-oriented, where the independent variable of the production function is a measure of health outcome or real value of the health services. It can also be measured as cost-oriented, where the independent variable is a measure of health services cost. However, the choice of the output or cost measure depends on the issue at hand and the researcher's perception. Moreover, the multifactor productivity (MFP) growthis commonly calculated assuming only two inputs labor and capital with the output set equal to the value added.On the other hand, the more problematic issue is that the use of the value added- based growth accounting model at the aggregated level can yield biased estimates of MFP growth becausethe value added model ignores the impacts and the contributions of intermediate inputs to the growth of output. An alternative is to employ the gross output as the output measure and explicitly include intermediate inputs in addition to capital and labor (Gollop, 1983).

That is, the main underlying structural issue of using the value added model is that it can lead to biased measure of the MFP growth given the openness of the economy to trade.We have to consider the fact that an analysis of productivity change in an open economy (such as Bahrain) must be based on production function that includes intermediate materials (as they account for the contribution of the intermediate materials to the growth of the MFP) in addition to the primary inputs (labor and capital). Therefore, given the main approaches in productivity and production modeling, the gross output production function model is exploited in this study as in Cutler *et al.* (2001).

In this paper the growth of aggregate output is represented as a combination of the contributions of growth of the respective production inputs (capital, labor, and intermediate materials) and the MFP growth. Thus a simple definition of MFP growth is the difference between the output growth and weighted average growth of all inputs where the weights to these inputs are their shares in the total cost of output. Assuming that output is measured in a physical unit (real value), then MFPis measured as the ratio of gross output Q to an aggregated input X (MFP = Q/X), where X has to be computed by aggregation as Divisia indexes.[2] We consider a general form of a production function with Hicks-neutral technology and expressed as:

$$Q_t = A_t f(X_{it}) \tag{1}$$

where Q_t stands for aggregate output (or real value) at time t, A_t is the level of technology (is the index of MFP), X_{it} is the amount of input (i) in time t and $i = K, L, M$, all in time period t. That is, $X_{it} = (K_{it}, L_{it}, M_{it})$ where K_{it} is the flow of physical capital used in production, L_{it} is the amount of labor inputs, and M_{it} is the amount of other production inputs all in time period t. Differentiating the production function with respect to time, agrowth equation can be written as:

$$\frac{dQ/dt}{Q} = \frac{dA/dt}{A} + \sum_i \frac{\partial Q}{\partial X_{it}} \frac{X_{it}}{Q} \frac{dX_{it}/dt}{X_{it}} \tag{2}$$

Therefore, the above growth equation decomposes the growth of output in the economy into the growth rate of inputs (the growth rate of the aggregated input is equal to the weighted sum of the individual inputs' growth rates) and the growth rate of MFP (the unexplained part of the output growth).

The growth rate of MFP is calculated using a Törnqvist index in which MFP growth is additive in output and inputs. Hence comparing periods*t* and $t - 1$, letting Q denotes real output, and X denotesthe input, the Törnqvist MFP growth rate $(\hat{g}_{MFP})$ can be presented as:

$$\hat{g}_{\text{MFP}} = \ln \frac{A_t}{A_{t-1}} = \ln \frac{Q_t}{Q_{t-1}} - \sum_i \overline{S}_{it} \ln \frac{X_{it}}{X_{it-1}} \tag{3}$$

where $\overline{S}_{it} = C_{it}/(P_{Qt}Q_t)$, $C_i$is the total payment to ith input, $i = K, L$, and M, and P_Q is the price of output (Q). The model's assumptions also imply that the weights (shares) sum up to one and $\overline{S}_{it} = (S_{it} + S_{it-1})/2$. Equation (3) shows that the growth rate of MFP $(\hat{g}_{MFP})$ can be seen as the deviation of the growth rate of output from the growth rate of inputs. One of the advantages of this method is that the Hicksian parameter (technological change, A) or $(\hat{g}_{MFP})$ can be measured using price and quantity data. The technological change (A), however, is a valid measure of $(\hat{g}_{MFP})$ given the model's assumptions, essentially, no inefficiency, full capacity utilization, and constant returns to scale.

4. THE DATA: MEASUREMENT SOURCES

Bahrain statistics categorizes Bahrain health services sector according to the International Standard Industrial Classification System (ISIC).The Bahrain health services sector includes both the public and the private health services providers. All time series data used in this study are obtained from the Central Statistical Organization, the official data sources in Bahrain. The time period covered in this study is from 2005 to 2009 (the latest data available). This time period has been chosen mainly due to the availability of data and most importantly, this period provides the most consistent and reliable data. Moreover, the study time period could be considered as the most crucial time period for the policy makers in terms of the new strategic economic plan of *Bahrain Economic Vision 2030*. Output and inputs of the health sector in Bahrain are given in the *National Accounts* which provide the most detailed structure of Bahrain economy. This account is produced

annually in which the gross outputof the BHSSisadjusted for price changes to measure gross output of BHSS at constant prices.The BHSS expenditure on inputs is also converted into a volume measure (constant price).

Production-function based productivity studies make use of aggregatedoutput and inputs which are generally identified as capital (K), labor (L), energy (E), and intermediate materials (M). In short these inputs are known as KLEM. However, given that no separate data were available for the energy input for the BHSS, the energy as an inputhas been included in the intermediate materials (M).

4.1. The Output (Q)

The output of the health care sector in the conventional national accounting approach excludes the value of improvements in the health status of populations.In most of productivity studies, output is measured in physical or real values. In this study, output is defined as the real values receipts from all services (output). The measurement of output in constant price (real value) in Bahrain's National Accounts is derived through a double deflation method by adjusting for price changes in sector's output and intermediate inputs including energy, materials and services purchased from other industries or imported.

4.2. The Inputs

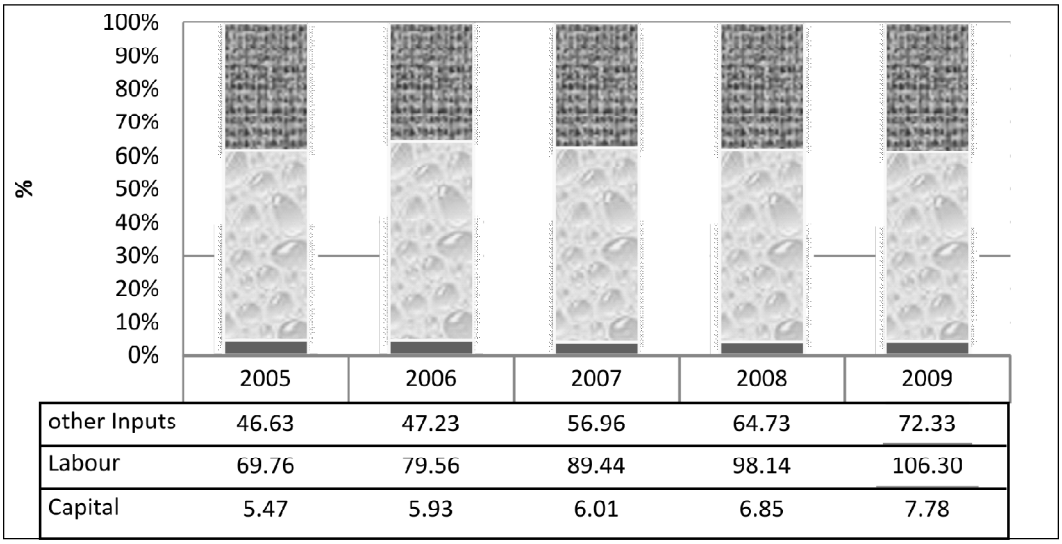
The data on capital input (K) is probably easier said than done to find and it is the most challenging to measure. That is, the flow measure of the capital input reflects differences in usage and how the differences influence the different level of output. The flow measure of capital could be a good indication of the amount of capital employed to produce the current output. However, in practice the data are generally not available in the details that are necessary for a capital flow to be constructed and measured. Thus, due to many difficulties of measuring the capital flow, in productivity studies the capital depreciation is normally used. It follows that the capital depreciation (in real terms) has been used as a measure of the cost of the capital services in this study.

For labor input, the real value of compensation is used as a measure of labor input (L) to take into account the difference in skills among workers assuming that there is a strong relationship between wages and the labor's level of skills and experience.The compensation consists of all payments, both in cash and kind, and the supplement to wages and salaries.

In this study, the other-inputs (M) are defined as equal to the real value of the purchases of materials and supplies for production including all other inputs than labor and capital. In other words, other-inputs represent the cost of all production input excluding the cost of labor and capital inputs.

Chart 1 shows the real-value of the inputs used in the BHSS over the period 2005 – 2009. We see from the Chart 1 that the capital-input had a very low share in the total cost of inputs. However, as expected, labor had the largest share in the total costs of the inputs. Thus, we can label the BHSS as a labor intensive industry.

Chart 1: Bahrain Health Services Sector-Inputs in Real Value (Million BD), 2001=100



	2005	2006	2007	2008	2009
other Inputs	46.63	47.23	56.96	64.73	72.33
Labour	69.76	79.56	89.44	98.14	106.30
Capital	5.47	5.93	6.01	6.85	7.78

5. EMPIRICAL FINDINGS

Estimates of the growth rate of output in the BHSSby identifying sources are presented in this section. As discussed above and shown in equations (2) – (3) that the sources of the gross output growth are (1) the growth of the inputs, and (2) the growth of MFP which is the difference between the growth rate of gross output and the growth rate of inputs all inputs capital, labor, and other-inputs. Table 2 shows the annual growth rates of the gross output, inputs, and MFP in BHSS during the time period of 2006-2009.[3]

Table 2
Annual Growth Rates of Gross Output, Inputs, and Multifactor Productivity in Bahrain Health Services Sector, 2006 – 2009

	Annual Growth Rate (%)		
Year	*Output*	*Inputs*	*MFP*
2006	9.10	8.76	0.34
2007	12.45	12.51	-0.06
2008	11.45	10.85	0.60
2009	11.59	9.56	2.03
2006-2009	11.15	10.42	0.73

We can see in Table 2 that the annual growth rate of the gross output in the BHSS ranged from a maximum of 12.45% in 2007 to a minimum of about 9% in 2006. The average annual growth rate of the gross output of the BHSS over the period 2006 – 2009 was little more than 11%. Table 2 also shows that only in 2007 the annual growth rate of the gross output in the BHSS was lower than the growth rate of inputs. This was due to the negative impact of the MFP growth rate in 2007.

More importantly, the MFP has been contributing insignificantly (less than 1% on average) to average annual growth rate of output over the time period of 2006 – 2009. From a negative growth rate in 2007, the MFP started to a positive and increasing growth rate in 2008. The growth of the MFP had its maximum annual contribution to the annual growth rate of output of about 2% in 2009. This clearly indicates that the high growth of the inputs was the major contributor to the output growth in BHSS. This impliesthere is a large opportunity for significantly improve the contribution of productivity to the growth of output in BHSS. This calls for the decomposition of productivity growth to find the main source of such low contribution of the MFP to the growth of output in BHSS.

Table 3 presents the estimated contributions of the growth rate of each input (capital, labor, and other-inputs) along with the growth rate of MFP to the growth rate of the gross output in the BHSS. During the period 2006-2009, capital on average contributed about 1% to the annual average 11.15% growth rate of gross output. However, there is an encouraging positive trend of capital contribution that may be an indication of the modernization of the health services.

Table 3
The Annual Contributions of the Inputsand MFP to the Growth Rate of Output in BHSS, 2006–2009

Annual Growth Rates (%) *year*	*Capital*	*Labor*	*other Inputs*	*MFP*	*Output*
2006	1.09	7.27	0.40	0.34	9.10
2007	0.16	6.63	5.72	-0.06	12.45
2008	1.55	5.28	4.02	0.60	11.45
2009	1.54	4.44	3.58	2.03	11.59
2006-2009	1.09	5.90	3.43	0.73	11.15

Labor had been the main contributing factor to the output growth. Out of 11.15% average annual growth rate of gross output during the period 2006 – 2009, labor contributed 5.9%. Interestingly the contributions of labor and the other inputs had been decreasing over time. Most interesting cases are presented in later years 2008 and 2009. Output growth rates remained around 11.5% during these years when capital contributed at a steady rate of 1.55$%, contributions of labor and other

inputs steady decreased which were compensated by increase in the growth rate of MFP. This is indeed an encouraging sign and gives policy makers a clue of identifying the ways to improve and reform the BHSS.

6. CONCLUDING REMARKS

The findings of this studyare expected to beas practical and informative to the policy and decision makers in the BHSS. This study has tried to answer some critical and important questions: (1)What were the contributions of inputs in the high growth rates of the gross output of the BHSS in recent years? (2) What role did the MFP growth play in the growth rate of the gross output of the BHSS in recent years?

The findings of the study indicate that the MFP annual growth rate was relatively low (less than 1% on average) over the study time period 2006 – 2009. This means that the high annual growth rates of inputs have been contributing to the high annual growth rate of output in the BHSS. The low MFP growth rates could be attributed to underutilization of capacity, inefficiency and unexploited economies of scale in production. One encouraging fact is that the trend of the MFP growth rate in Bahrain health sector services has been improving since 2008which indicates a better and more efficient use of the available resources over the later years. This has helped to increase output growth rate even with the declining growth rates in inputs.

In conclusion there are significant possibilities for improvements in the economic performance of the BHSS through the improvement of the MFP growth rate which is a composite measure of the overall economic performance. That is, the observed change in the MFP (technological change) growth rate can be a result of various economic interactions in the production process, including scale economies, changes in capacity utilization, and inefficiency. If any of these major economic aspects of the production process could be improved, the resulting estimates of the MFP growth and contribution to the growth of output will also be enhanced. The importance of this study is that it has identified the problem (the low MFP growth). A full structural model is now needed to decompose productivity growth into its major components in Bahrain health services sector so that a more trustworthy policy decision can be made.

As it could be seen through the above discussion, it is obvious that multifactor productivity growth, particularly in health care, is naturally difficult to quantify and measure. Thus, the results herein show an attempt to inform policy makers and facilitators on the general trends of gross output, inputs, and multifactor productivity growth rates of the aggregated level of BHSS. It follows that this study comes to promote and motivate economic policy discussions that could achieve an efficient allocation of available resources in the BHSS.

NOTES

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1. On an international scale, the conventional national accounting of measuring output of the health sector leave out the value of improvements in the citizens' health. This point has been clearly stated by Nordhaus (2003, p. 10): "It is little understood outside the priesthood of national accountants that there is no serious attempt to measure the "real output" of the health care industry."
2. It can be shown that the relationship between the growth in MFP using value added (*dMFPV*) and the growth in MFP using gross output (*dMFPG*) is given by: $dMFP_{(Gross\ Output)} = (1\text{-}S_M)\ dMFP_{(value\ added)}$, where *Sm* is the share of intermediate input in gross output, averaged over *t* and *t-1* in a Törnqvist index (Oulton and O'Mahony, 1994).
3. Estimates for the year 2005 are not reported due to the lag operation of the measurement model.

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