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Healthcare Spending and Economic Growth in Saudi Arabia: A Granger Causality Approach

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Abstract— The purpose of this paper is to investigate the relationship between healthcare spending and economic growth in Saudi Arabia and the causal direction between them over the period 1981-2013 using Granger Causality approach. The result from the Granger causality test shows that there is a unidirectional causal relationship running from economic growth to healthcare spending. Economic growth positively Granger cause healthcare spending growth at one percent significant level while healthcare has an insignificant effect on Saudi economic growth. Economic growth as measured by GDP is strongly exogenous and whenever a shock occurs in the system (Saudi economy), healthcare spending must be reduced to maintain the long run relationship. In order to sustain Saudi healthcare system, Saudi health policy makers needs to formulate a long term healthcare policy that de-linking or insulate healthcare spending from current oil-revenue dependency.

Index Terms— Healthcare Spending, Economic Growth, Saudi Arabia, Granger Causality Approach

1 INTRODUCTION

Since the release of the Report of the Commission on Macroeconomics and Health (CMH)[1] in 2001, several countries have evaluated the recommendations in light of their unique country health and socioeconomic contexts and have embarked on steps to implement long-term macroeconomic policies that would secure health as an essential component of socio-economic development planning. Advocates of the positive link between health spending and economic growth projected that, sustained health spending enhances productivity (through better health status of workers) which ultimately promotes economic growth. Thus to these supporters, healthcare spending granger causes economic growth, all things being equal.[2-5]

The key deficiency, however, with this linkage stems from the fact that the general consensus is predicated on assumed (not empirically verified) causal relationship between the two variables. As far as search of available literature is concern, there is little of no compelling empirical evidence in support of this view as well as the magnitude of the healthcare spending effects on economic growth. In fact, there is significant empirical evidence in the literature to the effect that the direction of causality between the two variables could also run from economic growth to growth in healthcare spending or the causal effect could be bidirectional. The relationship between health and economic growth has been empirically investigated intensely, although, the evidence is mixed.[6-12] Moreover, most of empirical studies have focused on developed countries by using a panel data analysis. Therefore, a country-specific study on developing countries such as Saudi Arabia is relatively scarce.

The goal of this study is to investigate the relative impact of healthcare spending on economic growth in Saudi Arabia. Specifically, this research paper attempts to empirically answer the following questions: Is there a relationship between healthcare spending and economic growth? And, if a relationship exists, what is the direction of causality between these two variables? In other words, this study examines the extent to which a healthcare strategy is a relative growth factor for Saudi Arabia. The rest of the paper is organized as follows: A brief study of previous empirical studies is presented in section 2. An overview of Saudi healthcare spending is presented in section 3. Section 4 provides data and econometric approach used in the study. Empirical findings are discussed in section 5 and the main conclusions are stated in section 6.

2 LITERATURE REVIEW

The relationship between healthcare spending and economic growth has been empirically investigated intensely since the publication of the seminal papers in Kleiman[13] and Newhouse.[14] These two authors have argued that there is a strong positive correlation between the healthcare spending and economic growth.

On one hand, healthcare spending is hypothesized to be a function of real gross domestic product (GDP). Higher income implies that there is more money to spend on health. A large body of research within health economics indicated that variation in per capita healthcare spending could be mostly explained by variations in per capita GDP.[15-17] Fuchs[18] indicated that 85% of the scholars in the field of health economics agreed that aggregate income is one of the most important factors in explaining healthcare expenditure growth. On the other hand, it is also hypothesized that health is a capital and hence investment on health is an important source for economic growth. Theoretically, health is a determinant of human capital, and labor productivity. So, regarding health spending as an investment in human capital and accordingly the engine of growth, an increase in health spending is expected to lead to higher income.[19-22] More healthcare spending is expected to lead to better health status, which eventually must lead to more labor productivity and more competitive nation and hence more economic prosperity, which implying that the causal relationship between healthcare spending and economic growth may run in either or both directions.

As mentioned early, however, the relationship between healthcare spending and economic growth has been empirically investigated intensely, although, the evidence is mixed. For example, Culyer[23], Hansen and King[24] indicate, in their studies, that there is no long-run relationship between healthcare expenditure and GDP. Devlin and Hansen (2001) examined Granger causality between health expenditure and GDP and showed some (mixed) evidence that indeed there might be bi-directional causality between health spending and income. Bukhari and Butt[25] support for the existence of a long run relationship between GDP and health expenditure and the exogeneity of GDP in Pakistan. Hartwig[26] revisits the question whether health capital formation stimulates GDP growth in rich countries applying the panel Granger-causality framework. His results do not lend support to the view that health capital formation fosters long-term economic growth in the OECD area. Mehrara and Musai[27] support the existence of a long run relationship between GDP and health expenditure in Iran.

Recently, Sghari and Hammami[28] examined the causality between the real per capita health care expenditure and real per capita GDP in 30 developed countries. Their findings indicate that bi-directional causality relationship is predominant. The reviews of relevant literature validate the positive relationship between healthcare spending and economic growth with direction of causality running from economic growth to growth in healthcare spending without any feedback effects. To the best of the authors' knowledge, no study yet has been carried out in case of Saudi Arabia in finding out the casual relationship between healthcare spending and economic growth.

3 HEALTHCARE SPENDING IN SAUDI ARABIA

The Healthcare sector in Saudi Arabia is primarily managed and financed by the Government through the Ministry of Health (MOH) and number of semi-public organization who specifically operate hospitals and medical services for their employees. With a total of 244 hospitals (33, 277 beds) and 2,037 primary health care (PHC) centers, MOH comprised approximately 60% of the total healthcare services in Saudi Arabia.[29] The private sector also contributes to the delivery of health care services, especially in major urban centers, with a total of 125 hospitals (11, 833 beds) and 2,218 dispensaries and clinics. The private sector comprised about 21% of healthcare services in the country.[29] The Saudi Healthcare sector is structured to provide a basic platform of healthcare services to all citizens and expatriates working within the public sector with full and free access to all public healthcare services.[30-31]

During the last four decades, however, spending on healthcare services increased from 2.8% in 1970 to 6.9% in 2011.[29] According to Colliers International Healthcare report[32], between 2005 and 2008 Saudi government allocated approximately SAR 23.5 billion per annum with a cumulative amount of SAR 94 billion investment in the healthcare sector. However, in 2010 and 2011 there was a substantial increase in the healthcare budget which increased from SAR 30 billion (6.3% of total government budget) in 2008 to SAR 52 billion in 2009 (11% of total government budget) and to SAR 61.2 billion in 2010 (11.3% of total government budget). The budget allocation was further increased to SAR 68.7 billion (11.8% of total government budget) in 2011, a cumulative allocation of SAR 113 billion in last two years compared to SAR 94 billion in the previous four years.[32]

Saudi healthcare spending increased by 8.7% per year in real terms between 2000 and 2011, this was followed by an increase of 12.4% in 2012.[33] Changes in the ratio of health spending to GDP are the result of the combined effect of growth in both GDP and health expenditure. Between 1981 and 2012, the annual average growth in healthcare spending in real terms was about 1.3%, nearly 2.5 times greater than the growth rate in GDP per capita.[33]

Saudi government devoted on average 3.7% of its GDP to healthcare spending in 2011, down slightly from the peak of 4.5% reached in 2001.[34] This share, however, remains well below many developed and developing nations. For example, the United State had the highest share of its GDP allocated to healthcare services in 2011 (17.9%), followed by Netherlands (12%), Germany (11.1%), New Zealand (10.1%), Japan (9.3%), Jordan (8.4%), Turkey (6.7%), Iran (6.0%) and Egypt (4.9%). In terms of healthcare spending to GDP ratio, however, Saudi Arabia ranked 173 among 192 of the world's healthcare system.[34]

It is estimated that, government spending in healthcare services is expected to increase to

SAR 174 billion in 2017 due to the growing demand drivers for healthcare services in Saudi Arabia.[35] One of major drivers for healthcare services is the population growth. The Central Department of Statistics and Information (CDSI)[36] estimates the total Saudi Arabian population will reach 31.6 million by 2016, of which 22.8 million will be Saudi nationals. The expanding population, coupled with rising average income, will continue to feed demand for healthcare services. With an estimated population growth rate of 2.2% over the next four years coupled with the increasing of life expectancy in one hand and increasing occurrence of "lifestyle diseases" on the other hand, the supply of healthcare facilities struggles to keep pace with the burgeoning population, a situation recognized by the Saudi government who has recently introduced initiatives to encourage the private sector to match the shortfall of public healthcare services.[31,35]

4 DATA AND ECONOMETRIC APPROACH

4.1 Data

The main objective of this study is to investigate the causal relationship between healthcare spending and economic growth in Saudi Arabia. The dataset employed consists of annual data on healthcare spending and real GDP from 1981 to 2013. Data on healthcare spending and real GDP (*in local currency – Saudi Riyal*) were obtained directly from the Saudi Arabian Monetary Agency (SAMA) database.[33] All variables are expressed in natural logarithms which could reduce the problem of heteroscedasticity as log transformation compresses the scale in which the variables are measured.[37-38] Table 1 presents summery statistic of the data and the pairwise correlations of variables show strong and significant correlations between healthcare spending human ($\mathbf{ln}(\boldsymbol{hcs})$) and economic growth ($\mathbf{ln}(\boldsymbol{gdp})$) of Saudi Arabia during the 1981 to 2012.

Table 1: Summary Statistics and Pairwise Correlation Matrix

	ln(hcs)	*ln(gdp)*
Mean	9.817963	13.50892
Median	9.688684	13.31065
Maximum	11.16956	14.81886
Minimum	9.221280	12.67898
Std. Dev.	0.551551	0.652729
Skewness	1.081496	0.721067
Kurtosis	3.053041	2.298623
Jarque-Bera	6.436855	3.536064
Probability	0.040018	0.170669
Observations	33	33
Correlation		
ln(hcs)	1.000000	0.948085
ln(gdp)	0.948085	1.000000

Source: Authors estimation using EViews8.

4.2 Econometric Approach

To test the existence of causality, the Granger causality test developed from the seminal paper of Granger [39] is employed. Basically, this test seeks to ascertain whether or not the inclusion of past values of a variable *x* do or do not help in the prediction of present values of another variable *y*. If variable *y* is better predicted by including past values of *x* than by not including them, then, *x* is said to Granger-cause *y*. For this purpose, the following vector autoregressive model of lag order *n*, VAR (*n*), is utilized:

$$X_t = \alpha_1 + \sum_{i=1}^{n} \lambda_{1i} Y_{t-i} + \sum_{i=1}^{n} \gamma_{1i} X_{t-i} + \delta_1 Z + \varepsilon_{1t} \quad (1)$$

$$Y_t = \alpha_1 + \sum_{i=1}^{n} \gamma_{1i} X_{t-i} + \sum_{i=1}^{n} \lambda_{1i} Y_{t-i} + \delta_2 Z + \varepsilon_{2t} \quad (2)$$

Where (X_t) represents economic growth, (Y_t) represents healthcare spending and (Z) is a set of seasonal dummies exogenously included to capture any seasonal effects. A test of joint significance of the lagged values constitutes the Granger causality test. More specifically, healthcare spending is said to Granger-cause economic growth if some $(\lambda_i \neq 0)$ in equation 1. By the same logic, economic growth is Granger-causing healthcare spending if one or more$(\gamma_i \neq 0)$. An important issue here is the choice of the optimal lag length as all inference in the VAR is naturally based on the chosen lag order, i.e. the number of lags chosen in the above equations have a significant impact on the decision to reject or accept the null hypothesis. Hence, the Schwarz Information Criterion (SIC)[40] is employed to determine the optimal lag length(n).

5 EMPIRICAL RESULTS

It is well documented that Granger causality tests require the use of stationary variables, i.e. variables integrated of order zero.[41-42] Thus, as a preliminary step to the analysis, the order of integration of the variables is determined. Two standard unit root tests are employed—the augmented Dickey-Fuller (ADF)[43] test and Phillips–Perron (PP).[44] Under the ADF and PP tests, the series is assumed to be non-stationary. Hence, failure to reject the null hypothesis implies that the time series has a unit root. The ADF test checks for serial correlation by adding lagged values of explanatory variables. While the PP test uses a non-parametric method to take care of serial correlation in the error term without adding a lagged difference term.

Table 1 presents the results of the ADF and PP unit root test, which implies that both variables healthcare and economic growth ($lngdp$ & $lnhcs$) are stationary at their first difference level - I(1). Therefore, the VAR model is used to investigate the causal relationship between the two variables.

Table 1: Unit Root Test

Variables	ADF		PP		Decision
	Level	1st difference	Level	1st difference	
LnGDP	1.4804 (0.998)	-4.0927 (0.003)	1.0487 (0.996)	-4.0241 (0.004)	I(1)
LnConst	1.5694 (0.999)	-4.8354 (0.000)	2.1309 (0.999)	-4.8762 (0.000)	I(1)

Notes: Figures in the parenthesis are the probability value.
Source: Authors estimation using EViews8.

It should be noted that the Johansen and Juselius[45] technique was applied to test for the presence of cointegration relationship between the variables but the results revealed that there is no cointegration association between them. Both the trace test and the maximum eigenvalue test were below the 5% critical value, implying no cointegration. Hence, the standard methodology using Granger cause approach is preceded (*see Appendix I*).

Prior to testing for Granger causality relationship, the optimal lag order in the VAR model must be chosen[46-48]. The maximum number of lags is set at 4. All the information criterion procedure tests suggest one lag length as an optimal lag selection for the VAR model (*see Appendix II*). Results of causality test are presented in Table 2.

Table 2: Granger Causality Test

Causality	Lag Length	*F*-Statistic	*P*-Value
Healthcare ↛ Economic Growth	1 **	0.65038	0.426
Economic Growth ↛ Healthcare	1 **	21.0254	0.000
Healthcare ↛ Economic Growth	2	0.42590	0.657
Economic Growth ↛ Healthcare	2	9.24570	0.000
Healthcare ↛ Economic Growth	3	0.10196	0.958
Economic Growth ↛ Healthcare	3	4.62245	0.011

Notes:

1. *The notation Economic Growth ↛ healthcare represents the null hypothesis: Economic growth (GDP) does not Granger-cause Healthcare spending. A similar interpretation follows for the reverse test.*
2. *** denotes optimal leg length based on (AIC), (SC) and (HQ) Criterion test.*

Source: Authors estimation using EViews8.

From the χ^2-statistics, the null hypothesis that spending in healthcare does not cause or precede economic growth is not rejected. Instead, the Granger causality test lends support to the growth-driven hypothesis, i.e. healthcare spending is largely influenced by economic growth. Thus, a unidirectional causal relationship exists between healthcare spending and economic growth in Saudi Arabia, and the direction of causality is running from economic growth to healthcare spending without any feedback effects. The estimated VAR model is also subjected to a battery of diagnostic tests (see Table 3). These tests imply that the model is well-behaved: the errors appear to be normally distributed non-heteroscedastic and free of autocorrelation.

Table 3: Diagnostic Tests

Test	Test Statistic	P-value
VAR Residual Heteroscedusticity Test (without cross terms)	$\chi^2 = 3.457$	0.126
VAR Residual Heteroscedusticity Test (with cross terms)	$\chi^2 = 38.313$	0.073
VAR Residual Normality Test (Jarqua Bera)	$\chi^2 = 1.8857$	0.756
VAR Residual Serial Correlation LM Test (lags 1 to 12)	LM = 3.457 LM = 4.082 LM = 1.314 LM = 9.198 LM = 2.130 LM = 3.793 LM = 1.931 LM = 4.215 LM = 2.067 LM = 5.925 LM = 6.968 LM = 1.375	0.484 0.395 0.858 0.056 0.711 0.434 0.748 0.377 0.723 0.204 0.137 0.848

Source: Authors estimation using EViews8.

6 CONCLUSIONS

This paper investigated the causal relationship between healthcare spending and economic growth in Saudi Arabia over the period 1981-2013 using econometric analysis approach. The Augmented Dickey Fuller (ADF) test and the Phillips–Perron (PP) test were used to check for stationarity of time series of variables under investigation. The Granger causality test was utilized to establish the possible casual relationships among the variables. The unit root test reveals that all the variables were stationary at first difference. These unit root tests yield no evidence of co-integrating vector(s) between series, and thus, no long run stable relationship between healthcare spending and economic growth in Saudi Arabia. However, the result from the Granger causality test shows that there is a unidirectional causal relationship running from economic growth to healthcare spending. Economic growth positively Granger cause healthcare spending growth at 1 percent significant level while healthcare has an insignificant effect on Saudi economic growth. In other words, GDP is strongly exogenous and whenever a shock occurs in the system (Saudi economy), healthcare spending must be reduced to maintain the long run relationship.

Given the nature of Saudi Arabian economy as oil-resource-based economy, any vulnerability of oil revenues will result in dramatic decrease in healthcare spending. It is well documented that dependency oil-resource countries suffered from a weak and undiversified economic base.[49-52] These countries are highly vulnerable to boom-and-bust economic cycles, both internally and externally. Therefore, in order to sustain Saudi healthcare system, policy makers needs to formulate a long term Saudi healthcare policy that de-linking or insulate Saudi healthcare spending from current oil-revenue dependency.

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APPENDICES

Appendix I: Johanson-Juselius Cointegration Test

Date: 12/25/13 Time: 12:45
Sample (adjusted): 1983 2013
Included observations: 31 after adjustments

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Trend assumption: Linear deterministic trend
Series: LOGGDP LOGHC
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.284223	10.67232	15.49471	0.2325
At most 1	0.009833	0.306318	3.841466	0.5799

Trace test indicates no cointegration at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.284223	10.36600	14.26460	0.1890
At most 1	0.009833	0.306318	3.841466	0.5799

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix II: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LOGGDP LOGHC
Exogenous variables: C
Date: 12/25/13 Time: 14:04
Sample: 1981 2013
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-17.16044	NA	0.013473	1.368603	1.463761	1.397694
1	50.53085	**120.8773***	**0.000143***	**-3.180775***	**-2.895303***	**-3.093503***
2	51.96618	2.358039	0.000172	-2.997584	-2.521797	-2.852131
3	54.66972	4.055316	0.000192	-2.904980	-2.238878	-2.701346
4	56.33121	2.254874	0.000233	-2.737943	-1.881526	-2.476128

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion