The Directional Relationship between Health Expenditure and Economic Growth in Egypt (1980-2010)

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***Abstract*—**Health expenditure contributes positively in stimulating economic growth; this relationship is known as health-led growth hypothesis. However the directional relationship between health expenditure and economic growth was found to be moving in both directions. From one side good health affect labor supply positively, also it has a positive effect on educational returns and increases the incentive to save. On the other side with high levels of economic growth a country will have capacity to increase the resources advocated to health, and will have better infrastructure for swage and clean water.

This study will test health expenditure led growth hypothesis, through investigating the casual relationship between health expenditure and economic growth. The study employs VECM-model, the main findings indicate a one way directional Granger causality from economic growth to health expenditure in the short run, and one way granger causality from health expenditure to economic growth in the long run.

***Keywords*—**Economic Growth, Health expenditure, Granger Causality and VECM.

I. Introduction

HEALTH economists and policy makers interest in health is based on the intuition that a healthy population will be more productive than a sick one. Fogel (1993) [1], Barro & Sala (1995)[2] and Barro (1996)[3] were among the first examining the relationship between economic growth and health, and their research had subsequently gave rise to a substantial store of work focusing on the link between growth and health. In 1996 Pritchett and Summers [4] stated directly the relation between health and wealth as they wrote an article entitled "*Wealthier nations are always healthier nations"* they defended their idea on the bases that an increase in income will allow buying greater quantities of health enhancing goods.

In that sense, education is not the only important factor affecting the performance of the labor force and its productivity. Human capital may, in a broad sense, be considered to encompass education and health. Without a labor force with the minimum levels of education and health, a country would not be able to maintain a state of continuous growth.

II. Stylized Facts About Health Expenditure In Egypt

Egypt's spending on healthcare is notably low with only 5 percent of the GDP allocated to healthcare (WHO, 2012)[5]. Of this percentage, approximately 60 percent was attributed to private providers and only 40% to the public healthcare system in 2012 (WHO, 2012) [5]. In addition, approximately half of Egypt's public health facilities are experiencing significant shortages of medical equipment and primary care clinicians (Nandakumar et al., 1999) [6]. These shortages are of particular concern considering Egypt's lower average life expectancy of 71 years and high prevalence of infectious diseases, such as schistosomiasis, hepatitis C, trachoma, acute diarrhea and respiratory infections (WHO, 2004)[7]. Furthermore, there are no health insurance schemes available to the economically disadvantaged or for those who are not in formal or organized. Therefore, the Egyptian government began developing healthcare reform policies with the premise of providing and financing a basic level of health care services for its population.

Over the past decade and a half, Egypt's health expenditure had been increasing in absolute terms; it increased from 1.2 billion dollars in 1994/95 to 3.2 billion dollars in 2001/02, 4.5 billion dollars in 2007/08, and 6.3 billion dollars in 2009/2010, then reaching a high level of 6.8 billion dollars in the year 2011[3]. On a per capita bases, it increased from ($37.4) in 1995 to ($152) in 2012, while the percentage of health out of the GDP was fluctuating starting from (3.86%) in 1995, it reached its highest level in 2002 (6.13 percent) and then started declining till it reached (5%) in 2012.

III. Model Specification

This study used annual time series data for the period 1981-2010, we used the log of real health expenditure per capita (adjusted by the consumer price index setting 2005 as the base year) and the log of real GDP per capita (constant Egyptian pound, prices of 2005), the data was found in the Ministry Of

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http://dx.doi.org/10.15242/ICEHM.ED0415032

Health and Population (MOHP) and the World Bank (WB) respectively. The variables were transformed into logarithm form, in order to obtain normal distribution and also the differences in the logarithm for stands for the growth rate.

IV. Empirical Results

a) Unit root test:

i. Traditional unit root test:

The results if the traditional unit root tests namely; Augmented Dickey Fuller (ADF) test, and the Phillips-Perron (PP) test, is presented in table 1.

TABLE I
TRADITIONAL UNIT ROOT TESTS

Variable	Variable at the first difference			Variable at the second difference		
	Augmented Dickey Fuller			Phillips-Perron		
	Constant	Constant and linear trend	None	Constant	Constant and linear trend	None
Lrgdppc	-4.03 0.004	-4.12 0.0157	-1.507 0.121	-4.028 0.0044	-5.99 0.0002	-2.12 0.0343
Lrhepc	-4.039 0.0043	-4.233 0.0123	-4.143 0.0002	-4.21 0.0028	-4.308 0.0104	-4.287 0.0001

Source: prepared by the author based on E-views statistical package

Where,

$LRGDPPC_t$: log real GDP per capita,

$LRHEPC_t$: log real health expenditure per capita

The critical value for the constant at 5% level of significance is equal to -2.97185, while for the constant and linear trend is equal to -3.580623, and finally without linear nor constant is-1.95338.Based on the results of both the ADF test and the PP test unit root both variables were found non-stationary at the level, but when taking the first difference for both variables- real per capita health expenditure as well as the real per capita GDP- they were found stationary -integrated of level one (I(1))- however the GDP is found stationary only after adding a trend and constant or only a constant. These results are consistent to the assertion that most of the macroeconomics time series are non-stationary at level, but it is stationary after first differencing (Nelson and Plosser, 1982).

ii. Z-A unit root test:

Then we applied the Zivot and Andrews unit root test, the results are presented in table 2 the Z-A test results confirmed on the traditional tests' finding, however we found structural break in the per capita GDP variable only and it was in the year 1991.

TABLE II
Z-A TEST FOR UNIT ROOT WITH ONE STRUCTURAL BREAK

Sample period	Variable	
1981-2010	Real GDP per capita	Real health expenditure per capita
One structural break in the intercept: 1% critical value -5.34 5% critical value -4.93 10% critical value -4.58	Z-A test statistics: -3.297 P-value= 0.0124 Year of structural break is 1991	Z-A test statistics: -3.10 P-value= 0.0005 Year of structural break is 1997
One structural break in the trend: 1% critical value -4.8 5% critical value -4.42 10% critical value -4.11	Z-A test statistics: -3.254 P-value= 0.0132 Year of structural break is 2005	Near Singular. Regression may be perfectly collinear
One structural break in the trend and intercept: 1% critical value -5.57 5% critical value -5.08 10% critical value -4.82	Z-A test statistics: -3.4017 P-value= 0.010671 Year of structural break is 1991	

Source: prepared by the author based on E-views statistical package

After identifying the level of integration and as the data is found integrated of the same order we will have to determine the optimum lag length, we will use the unrestricted Vector Auto Regressive Model (VAR) in order to identify the number of lags, as shown in table 3 The entire lag selections criterion agreed that we have only one period lag in this model.

TABLE III
LAG LENGTH SELECTION

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-319.43	NA	5.04E+08	25.7142	25.8117	25.7413
1	-242.27	135.7954*	1451716.*	19.86169*	20.15422*	19.94282*
2	-241.54	1.16967	1901930	20.1232	20.6108	20.2584
3	-238.63	4.18529	2117320	20.2107	20.8933	20.4
4	-234.49	5.30405	2171598	20.1992	21.0768	20.4426
5	-230.5	4.47314	2310197	20.1997	21.2723	20.4972

* indicates lag order selected by the criterion

Source: prepared by the author based on E-views statistical package

Before we proceed it is advices to test the normality and autocorrelation of the residuals in order to make sure that the estimates we got are Best Linear Unbiased Estimates (BLUE), Portmanteau test was used to test for auto correlation; the null hypothesis states that no residual auto correlation, indicates that we can't reject the null hypothesis in all cases, which means we can't reject that there is no auto correlation between residuals[4]. Also normality test was implemented on the data; namely skewness test, Kurtosis test as well as Jarque- Bera test, in those three tests we were unable to reject the null hypothesis which states that residuals are multivariate normal.

b) Short run causality

The short run causality is examined using the granger causality approach; null hypothesis of this test is that one variable doesn't granger cause the other. The results of this test are found in table (4) the results indicate that we accept the first null hypothesis that LRHEPC do not granger cause LRGDPPC in the short run, while we don't accept the second null hypothesis which states that LRGDPPC don't granger cause LRHEPC.

TABLE IV
GRANGER CAUSALITY TEST

Null Hypothesis:	Obs	F-Statistic	Prob.
LRHEPC does not Granger Cause LRGDPPC	28	0.06796	0.9345
LRGDPPC does not Granger Cause LRHEPC		4.16063	0.0287

Source: prepared by the author based on E-views statistical package

As we proceed we can use the Toda Yamamoto test (1995) in order to check the results of the Granger causality test, the TY test is insensitive to having the data integrated of the same order or being cointegrated.

The results of the Wald test indicates that we reject that real per capita health expenditure granger cause GDP, while accepts that real per capita GDP granger cause real per capita health expenditure, i.e we have one way directional relationship running from GDP to health expenditure in the short run.

In summery in the short run there is one way directional relationship running from real GDP per capita to real health expenditure per capita, in other words GDP granger cause health expenditure in the short run.

c) Co-integration test:

i. Engle Granger

We will start by the residual test to identify if it was stationary at I(1), knowing that if we rejected the null hypothesis that the residuals have unit root we will reject also that the variables are not co-integrated, as shown in (table 6). The Engle Granger residual co-integration stated that we can reject the null hypothesis of the presence of unit root in the data after we take the first difference however we need also to compare the T-statistic with the critical value but as we believe that our sample is not large enough we will use the critical value presented by MacKinnon in 2010, as he adjusted the critical values to the sample size. As shown in the table the t-statistics is found to be -4.847 while the critical value adjusted is -3.78 thus we reject the null hypothesis of the existence of unit root and no cointegration[5]

[4]For checking the results the author used the LM test and it sated that there is no serial correlation between residuals

[5] Also the Johansen cointegration test was conducted as shown in the appendix in part A.1

TABLE V
TY- CAUSALITY TEST

VAR Granger Causality/Block Exogeneity Wald Tests							
Dependent variable: LRGDPPC				Dependent variable: LRHEPC			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
LRHEPC	0.131274	2	0.9365	LRGDPPC	9.408381	2	0.0091
All	0.131274	2	0.9365	All	9.408381	2	0.0091

Source: prepared by the author based on E-views statistical package.

TABLE VI
ENGLE GRANGER RESIDUAL CO-INTEGRATION TEST

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.847391	0.003
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

Source: prepared by the author based on E-views statistical package

d) Long run Causality test:

As we can't reject that the data is cointegrated, this means we have directional relationship in the long run (Granger, 1986), but we didn't identify in what way this directional relationship is working yet, we will apply VECM framework in order to be able to identify the directional relationship between real per capita health expenditure and real per capita GDP in the long run.

Equation (1) presents equation for the long run relationship –the number of lags and the number of cointegration equation was identified in the previous steps- the estimated equation that was provided by the E-views statistical package when setting the real GDP per capita as the dependent variable is equation (1')

$$DLRGDPPC_T = \alpha_0 + \sum_{T=1}^{1} \alpha_2 DLRGDPPC_{T-1} + \sum_{T=1}^{1} \alpha_3 DLRHEPC_{T-1} + \alpha_1 ECT_{T-1} \quad (1)$$

D(LRGDPPC) = C(1)*(LRGDPPC(-1) - 40.670238552*LRHEPC(-1)) + C(2)*D(LRGDPPC(-1)) + C(3)*D(LRHEPC(-1))

Where,

$DLRHEPC_T$: is the first difference for the real health expenditure per capita,

$DLRGDPPC_T$: is the first difference for the real gross domestic product per capita, and

ECT_{T-1}: is the error correction term

C(1)*(LRGDPPC(-1)-40.670238552*LRHEPC(-1))=ECT_{T-1}: is the cointegration equation

C(1) is α_1 :the coefficient of the cointegration equation

TABLE VII
VECM BY SETTING LRGDPPC AS THE DEPENDANT VARIABLE

Coefficient	Coefficient value	Std. Error	t-Statistic	Prob.
C(1)	-0.004734	0.001703	-2.77926	0.0102
C(2)	0.463465	0.177407	2.612442	0.015
C(3)	-0.107284	0.310198	-0.34586	0.7323

Source: prepared by the author based on E-views statistical package.

As C(1) is found negative and significant, thus the real per capita health expenditure causes the GDP is the long run.

When setting the real per capita GDP as the dependant variable we found long run causality running from health expenditure to GDP.

We will proceed by setting the real per capita health expenditure as the dependant variable, where the general form equation is equation 2, while the one produced by the E-views is 2':

$$DLRHEPC_T = \beta_0 + \sum_{T=1}^{1} \beta_2 DLRHEPC_{T-1} + \sum_{T=1}^{1} \beta_3 DLRGDPPC_T + \beta_1 ECT_{T-1} \quad (2)$$

D(LRHEPC) = C(1)*(LRHEPC(-1) - 0.0245880042902*LRGDPPC(-1)) + C(2)*D(LRHEPC(-1))+C(3)*D(LRGDPPC(-1))

Where,

C(1)*(LRHEPC(-1) - 0.0245880042902*LRGDPPC(-1)) =

ECT_{T-1}: is the cointegration equation

C(1) is β_1 :the coefficient of the cointegration equation.

TABLE VIII

VECM BY SETTING LRHEPC AS THE DEPENDANT VARIABLE

Coefficient	Coefficient value	Std. Error	t-Statistic	Prob.
C(1)	-0.061862	0.050774	-1.21839	0.2345
C(2)	-0.09159	0.227338	-0.40288	0.6905
C(3)	0.231326	0.130018	1.779187	0.0874

Source: prepared by the author based on E-views statistical package

The coefficient of the ECT_{T-1}; which is c(1) is negative but is not significant as the P-value is greater than 5% so we are going to accept the null of hypothesis

When setting the real per capita health expenditure as the dependant variable we found no long run causality between real per capita GDP and real per capita health expenditure.

From the causality analysis, in both the long run and the short run we can conclude that:

1. In the long run there is one way directional relationship running from health expenditure to GDP in Egypt.
2. In the short run there is one way directional relationship running from GDP to health.

V. CONCLUSION

The study found that in order to justify the differences in health status among different countries differences in health expenditure will be a good starting point. Income was found to be the most important determinant of health expenditure in most of the previous studies, but the directional relationship between health expenditure and economic growth was not found to be uniform.

The empirical study tried to identify the direction of granger causality between health expenditure and economic growth in Egypt during the period 1980-2010 through using the annual data for real per capita health expenditure as well as real per capita GDP. The Johansen-Juselius cointegration test suggests that the variables are cointegrated, implying that there is a unique long-run equilibrium relationship between health spending and income in Egypt. With the finding of cointegration, we investigated the direction of causality between the variables through the VECM framework, the results showed that in the short run we have one way directional relationship running from real GDP per capita to real health expenditure per capita, while in the long run we have one way directional relationship running from real health expenditure per capita to real GDP per capita.

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