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Health Care Expenditures and Economic Growth in Developing Countries: Panel Co-Integration and Causality

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Abstract: This paper investigated the causality and co-integration relationships between economic growth and health care expenditures in developing countries during 1990-2009. This paper concentrated on panel co-integration and causality in VECM framework. The findings revealed that there is a short-run causality from GDP to health care spending, while it is not observed any short-run causality from health spending to economic growth. Likewise, there is a bilateral causality and long-run relationship between economic growth and health spending. In other words, the findings indicated that income is an important factor across developing countries in the level and growth of health care expenditure, in long-run. As well, the health-led growth hypothesis in developing countries is confirmed.

Key words: Health Care Expenditure · Economic Growth · Panel Co-integration

INTRODUCTION

The role of health care spending on stimulating economic growth has been suggested by Mushkin [1]. This is known as the health-led growth hypothesis. According to this hypothesis, health is a capital, thus investment on health can increase income, hence lead to overall economic growth. In fact, health can affect economic growth through its impact on human and physical capital accumulation [2-3]. Likewise, given that healthier people are more productive. Thus, people who are healthy have a strong incentive to develop their knowledge and skills because they expect to enjoy the benefit over longer period [2, 4-6]. By contrary, Poor health has an adverse impact on productivity, thus it appears to be a key factor in explaining the existence of underdevelopment in many regions throughout the world [7].

On the other hands, economic growth can also improve the health-state of population by two aspects: First, economic growth implies rising per capita income and part of this increased income has spent into the consumption of a higher quantity of and better quality of nutritious food. Consequently, health improves [8]. Second, economic growth is fuelled by technological progress and part of this progress is reflected in improvements in medical science. For example, Newhouse [9] suggested that technical change is the major force in the growth of health care expenditure in different countries. Fuchs [10] indicated that in the United States, 85% of the scholars in the field of health economics agreed that "technical change" as suggested by Newhouse has driven the rapid growth of health care expenditure in the United States in the past three decades. On the other hands, since the health is deemed as a capital, thus subject to the assumption of diminishing marginal return [4]. From the microeconomic view point, when individual's income is low (poor), demand for medical care tend to be low. As a result, the marginal rate of return to invest in health via medical care is high. Thus, a small increase of income will strongly improve health state. While, once individual reaches a very healthy and wealthy state, an additional income will not make this individual healthier, but stagnant. Thus, the effect of economic growth on health is concave and depending on the level of development [11].

Although, studies about of the interaction between health and economic growth have been flourishing recently, but also, they are still scarce, in particular for developing countries. Baltagi and Moscone [12] reconsidered the long-run economic relationship between health care expenditure and income using a panel of 20 OECD countries during 1971-2004. As well, they studied the non-stationary and co-integration properties between

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health care spending and income. The findings suggested that health care is a necessity rather than a luxury, with elasticity much smaller than that estimated in previous studies. Also, Hartwig [13] revisited the question whether health capital formation stimulates economic growth in rich countries applying the panel Granger-causality framework. His results did not lend support to the view that health capital formation fosters long-term economic growth in the OECD area. Wang [14] explored the causality between an increase in health care expenditure and economic growth for OECD countries during 1986-2007. The empirical procedure is divided into two parts. The first is the panel regression analysis and the second is the quantile regression analysis. The estimation of the panel regression reveals that, expenditure growth will stimulate economic growth; however, economic growth will reduce expenditure growth. With regard to the estimation of quantile regression, when economic growth is quantile, in countries with low level of growth, the influence of expenditure growth on economic growth is different. In countries with medium and high levels of economic growth, the influence of expenditure growth on economic growth is positive; when health care expenditure growth is quantile, the influence of economic growth on expenditure growth is more different.

Tang [15] employed the Granger causality test within a multivariate co-integration and error-correction framework to investigate the relationship between health care spending, income and relative price in Malaysia during 1970 - 2009. The findings showed that in the short-run there is unidirectional Granger causality running from relative price to health care spending, while relative price and income are bidirectional Granger causality in Malaysia. In the long-run health care spending and income are bidirectional Granger causality, while there is unidirectional Granger causality running from relative price to health care spending and income. Mehrara and Musai [16] examined causal relationships between Health expenditure and GDP for Iran using annual data over the period 1970-2008. The results from co-integration technique suggested that there is a long-run relationship between these variables. Also, the results of Granger Causality test indicates a strong unidirectional effect from GDP to health expenditure, although providing no support to the view that health expenditure promotes long-term economic growth. In other words, the evidence for Iran clearly supports the 'Income View' over the 'Health View'. Hassan and Kalim [17] the existence of long run association and triangular causality among real GDP per capita, per capita education expenditures and per capita health expenditures in Pakistan, using ARDL bounding and Granger Causality tests during 1972-2009. The findings show that there is bidirectional granger causality among real GDP per capita, per capita education expenditures and per capita health expenditures in long run.

However, the recognition of the existence of a relationship between health and economic growth is important, especially for developing countries. Hence, this paper concentrates on the existence of causality and long-run relationships in developing countries using panel co-integration method.

MATERIALS AND METHODS

This paper evaluated the causality and long-run relationship existence between economic growth (GDP) and health care expenditures (HC) in 20 developing countries using Panel Co-integration approach. Data are annually, constant price 2000 (USD) that extracted from World Bank. As well, the studied period was 1990-2009 considering availability of data.

However, to test the nature of association between the variables while avoiding any spurious correlation, the empirical investigation in this paper follows the three steps: first, we test for non-stationarity in the variables of GDP and HC. We used the Im, Pesaran and Shin unit root test [18] that assumes the series are non-stationary. Second, we look for being of long- run relationship between variables using the panel co-integration test. The Engle and Granger [19] co-integration test is based on an examination of the residuals of a spurious regression performed using I(1) variables. If the variables are co-integrated, the residuals will be I(0). On the other hand, if the variables are not co-integrated, the residuals will be I(1). Pedroni [20-21] extend the Engle-Granger framework to tests that involve panel data. This co-integration test has several testing methods: the panel v-statistic, panel ρ-statistic, panel PP-statistic, panel ADF statistic, group ρ-statistic, group PP-statistic and group ADF-statistic. However, co-integration implies that causality exists between the series but it does not indicate the direction of the causal relationship. Hence, we test for Granger causality in VECM framework as follows:

$$\Delta \mathrm{GDP}_{i,t} = \propto_{1,i} + \varphi_{1,i}\ \mathrm{ECT}_{i,t} + \sum_{j=1}^{k} \gamma_{1,j,i}\ \Delta \mathrm{HC}_{\mathrm{i,t\text{-}j}} + \sum_{j=1}^{k} \theta_{1,j,i}\ \Delta GDP_{i,t-j} + \varepsilon_{1,i,t} \quad (1)$$

$$\Delta HC_{i,t} = \propto_{2,i} + \varphi_{2,i}\ ECT_{i,t} + \sum_{j=1}^{k} \gamma_{2,j,i}\ \Delta HC_{i,t-j} + \sum_{j=1}^{k} \theta_{2,j,i}\ \Delta GDP_{i,t-j} + \varepsilon_{2,i,t} \quad (2)$$

Where i (i = 1,...N) denotes the country, t (t = 1,...T) the period, j is the optimum lag considering SBC criteria. Also, Δ is a difference operator; *ECT* is the lagged error-correction term derived from the long-run co-integrating relationship; the φ_1 and φ_2 are adjustment coefficients and the $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$ are disturbance terms assumed to be white-noises and uncorrelated. We determined the sources of causation by testing for significance of the coefficients on the lagged variables in above equations: First, we evaluate Granger short-run causality using F-statistic by testing H_0: $\gamma_{1,j} = 0$ or H_0: $\theta_{2,j} = 0$ for all i and j, in eqs.(1) and (2), respectively. If the null hypothesis is rejected, then the existence of Granger short-run causality (Granger weak causality) is confirmed [22]. Second, we identify Granger long-run causality using the ECT (error correction terms) coefficients in above equations. The coefficients on the ECTs represent how fast deviations from the long-run equilibrium are eliminated following changes in each variable. If the ECTs coefficients are zero ($\varphi_{1,i} = 0$, or $\varphi_{2,i} = 0$) for all i, then there is no Granger long-run causality from explanatory variable to dependent variable. Final, we can jointly check the existence of both Granger short-run and long-run causalities using F-statistic by testing H_0: $\gamma_{1,j} = 0$ or $\varphi_{1,i} = 0$, for all i and j, in eqs.(1) and (2), respectively. This is referred to as a strong Granger causality test.

RESULTS AND DISCUSSION

Table 1 presents the results of the Im, Pesaran and Shin (IPS) unit root test. The IPS statistics indicate that both variables are stationary after first differencing. In other word, both variables are integrated of order (1).

Table 2 reports the results of the panel co-integration test induced by Pedroni [18]. The results clearly indicate that there exists a co-integrated relationship between health spending and economic growth in long-run.

However, the existence of a co-integration relationship does not give any information on the causality relationship between the variables. Therefore, we use Granger causality test in the critical values at 5% in VECM framework. The results of the F test for both long-run and short-run causality are reported in Table (3). The findings indicated that there is a short-run causality from GDP to health care spending, while it is not observed any short-run causality from health spending to economic growth. In addition, the coefficients of the F-statistic for ECT in both equations are statistically significant. Therefore, there is a bilateral long-run causality between *GDP* and *HC*. In other words, economic growth plays an important role for expanding health care spending in long-run. Also, health spending increases act as an engine of economic growth for developing countries in long-run. Furthermore, the joint test indicates that there is a bilateral strong causality between variables. In other words, whenever a shock occurs in the system, the variables would make short-run adjustments to restore long-run equilibrium.

Table 1: Results of IPS Unit Root test

Variables	Level	Prob.	First Difference	Prob.	Result
HC	0.279	0.610	-3.407	0.0003	I(1)
GDP	-0.634	0.261	-4.625	0.0000	I(1)

Table 2: Results of the Pedroni Panel Co-integration test

Test statistics	Statistic	Prob.
Panel v-statistic	0.619639	0.2677
Panel ρ-statistic	-1.626480	0.0519
Panel PP-statistic	-3.346810	0.0004
Panel ADF-statistic	-3.932879	0.0000
Group ρ-statistic	-1.638484	0.0507
Group PP-statistic	-1.946363	0.0258
Group ADF-statistic	-1.822945	0.0342

Table 3: Results of Panel causality tests (F-statistics)

	Source of Causation(explanatory Variable)				
	Short-run		Long-run	Joint (short-run/long-run)	
Dependent Variable	ΔHC	ΔGDP	ECT(-1)	ΔHC, ECT(-1)	ΔGDP, ECT(-)
ΔHC	-	2.23**	-3.16**	-	3.41**
ΔGDP	1.18	-	-3.88**	2.91**	-

* All figures are the calculated F statistics.

** Significant at 5%.

The study revealed that there is a bilateral causality and long-run relationship between economic growth and health spending. In other words, the findings indicated that income is as an important factor across countries in the level and growth of health care expenditure. As well, the significant impact of health spending on economic growth justifies the necessity of governments' intervention aimed by implementing the policies to encourage health spending required to build up a healthier and productive society to support economic growth and development in developing countries.

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