Does Economic Growth Influence Health Expenditures? Empirical Evidence from a Panel of Selected Developing Countries

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Abstract

In this paper we examine the role of real per capita gross domestic product (GDP) in determining per capita health care expenditure. We take a panel co integration approach in order to explore the possibility of estimating impacts of economic growth. Our empirical analysis is based on 13 developing countries: Algerie, Bahrein, Egypte, Jordan, Lebanon, Marok, Oman, Qatar, Saoudite, Syria, Tunisia, Emirates, and Yemen for the period 1995–2011. We find that per capita GDP exert a statistically significant positive effect on per capita health care expenditure.

Keywords: health care expenditure, GDP, developing countries, panel co integration.

1. Introduction

This paper analyzes the causality between the real per capita health care expenditure (HCE) and real per capita GDP in 13 developing countries: Algerie, Bahrein, Egypte, Jordan, Lebanon, Marok, Oman, Qatar, Saoudite, Syria, Tunisia, Emirates, and Yemen from 1995 to 2011.

Recently, health care economists have devoted a great deal of attention to analyzing the time series pattern of HCE and GDP. Most of the literature on the factors of health care expenditure growth focuses on the effect of income, usually proxies by per capita Gross Domestic Product (GDP).

The aim of this paper is to find out if the long-run relationship between the increase in HCE and economic growth is stable, and probe into their short-run causal relationship and its influence. In addition, the paper aims to know whether the relationship between the two is still positive. These questions have never been discussed in developing countries.

As stated above, most of the literature on the determinants of health expenditure is focused on the relationship between health care expenditure and income. In general, it argues that there is not only a strong positive correlation between per capita healthcare expenditure and per capita income in developed countries, but also that per capita income explains a high percentage of the variation in health expenditure.

We organize the balance of the paper as follows. In the next section, we provide a brief overview of the literature on the impacts of economic growth on health expenditure. In Section 3, we present the estimable model. In Section 4, we provide a brief discussion of the estimation technique and we discuss the results while in Section 5 we conclude with some policy implications.

2. An overview of the literature
As highlighted earlier, there is a large literature on the impacts of economic growth on health expenditure. Thus, it is impossible to review all of the studies. In this section, we only review some selected studies that reflect a good mix of the overall literature. We begin with a study by Kleiman (1974) and Newhouse (1977). The relationship between real per capita HCE and real per capita income has been profusely analysed since the publication of the seminal papers in Kleiman (1974) and Newhouse (1977). These two authors studied the factors affecting HCE in different countries through a cross-sectional analysis of international data. They have argued that there is a strong positive correlation between these two variables of the developed economies. Also, they indicate that the high percentage of the variation of the per capita HCE is explained by the per capita GDP. Also, Newhouse (1977) examined 13 OECD countries and found that income is the most critical factor in the difference in HCE among countries.

In addition, Culyer (1990) studied individual OECD countries using pooled data and found a significantly positive correlation between HCE and GDP. However, time-series analysis is related to the stationary series of the variables and spurious regression.

In the majority of relevant studies, real per capita HCE is hypothesized to be a function of real per capita income (Milne and Molana, 1991; Gerdtham and Jonsson, 1991; Hitiris and Posnett, 1992). Fuchs (1996) wrote that 85% of the scholars in the field of health economics agreed that income is the most important variable of HCE. But, these researches cannot explain the increase in HCE in all countries. Numerous empirical literatures have probed into the international factors affecting HCE; however, they tend to focus on the relationship of HCE with income. Thus, Hansen and King (1996) and Blomqvist and Carter (1997) indicate, in their studies, that there is no long-run relationship between HCE and GDP and find that these two variable are non-stationary.

Moreover, Gerdtham and Löthgren (2000) suggested a precise analysis on the relationship between HCE and GDP. They studied 20 OECD countries from 1960 to 1997 using Country-by-Country and panel data analysis in order to ascertain the factors affecting HCE. The empirical result of their study proposed that HCE and GDP are non-stationary time series and there is a co integration between them.

Over the last few years, the debate on this link has moved on whether the income elasticity of HCE is greater or less than 1 (Bac and Le Pen, 2002). On the one hand, income elasticity less than 1 classified HCE and income inelastic, therefore, as a “necessary” good. On the other hand, if the elasticity is higher than 1, health will be classified as a “luxury” good. In summary, the empirical literature on the determinants of HCE shows that aggregate income is one of the most important factors in explaining HCE growth.

In addition, the results of Dregerd and Reimers (2005), using panel cointegration techniques, show that HCE are not only determined by income. Another of theirs conclusions is that HCE is not a luxury good. Meanwhile, using local quantile regressions for 154 countries, Chen, Lin and Chang (2009) determined that HCE is a necessity good for countries with per capita income lower than $1920.

Moreover, Baltagi and Moscone (2010), Using co integration properties between HCE and income; determined that HCE is a necessity rather than a luxury, with an elasticity much smaller than was estimated in previous studies. Similarly, Mehrara, Musai and Amiri (2010) using data for 1993-2007 their findings suggest concluded that income elasticity for all of members of OECD is about 2.59, much more than the unit. They also estimated that income elasticity of HCE over time and across the countries has been rather unvarying.

Concerning the most recent studies, Liu, Li and Wang (2011) have tested for...
structural breaks with panel varying coefficient models doing an application to OECD health expenditures. These findings indicate a full sample income elasticity of 1.603, in line to the results found by Woodward and Wang (2011) for the US national HCE.

Table 1: Summary of previous studies.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Sample</th>
<th>Model description</th>
<th>Elasticity of income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newhouse (1977)</td>
<td>13 developed countries</td>
<td>Cross section</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Leu (1986)</td>
<td>19 OECD countries</td>
<td>Cross section</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Parkin et al. (1987)</td>
<td>18 OECD countries</td>
<td>Income elasticity</td>
<td>Income elasticity close to unity</td>
</tr>
<tr>
<td>Hitiris and Posnett (1992)</td>
<td>20 OECD countries</td>
<td>Time series</td>
<td>No long-term relations hip</td>
</tr>
<tr>
<td>Gbesemete and Gerdtham (1992)</td>
<td>30 African countries</td>
<td>Time series</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Hansen and King (1996)</td>
<td>20 OECD countries</td>
<td>Replicated model</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Hitiris (1997)</td>
<td>10 OECD countries</td>
<td>Time series</td>
<td>Long-term relations hip</td>
</tr>
<tr>
<td>Blomqvist and Carter (1997)</td>
<td>18 OECD countries</td>
<td>Time series</td>
<td>Long-term elasticity between income and health expenditure</td>
</tr>
<tr>
<td>Mccoskey and Selden (1998)</td>
<td>10 OECD countries</td>
<td>Panel data</td>
<td>Panel cointegration techniques</td>
</tr>
<tr>
<td>Roberts (2000)</td>
<td>154 countries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gerdtham (2000)</td>
<td>20 OECD countries</td>
<td>Semiparametric panel varying coefficient model</td>
<td>Local quantile regressions</td>
</tr>
<tr>
<td>Okunade and Murthy (2002)</td>
<td>10 European countries</td>
<td>United States</td>
<td>Health care is a necessity for 37 countries with per capita income lower than $1920 and is luxury for other countries</td>
</tr>
<tr>
<td>Clemen te et al. (2004)</td>
<td>OECD countries</td>
<td>15 OECD countries</td>
<td>16 OECD countries</td>
</tr>
<tr>
<td>Sen (2005)</td>
<td>OECD countries</td>
<td>21 OECD countries</td>
<td>10 OECD countries</td>
</tr>
<tr>
<td>Dreger and Reimers (2005)</td>
<td>OECD countries</td>
<td>20 OECD countries</td>
<td>20 OECD countries</td>
</tr>
<tr>
<td>Chen, Lin and Chang (2009)</td>
<td>OECD countries</td>
<td>OECD countries</td>
<td>154 countries</td>
</tr>
<tr>
<td>Baltagi and Moscone (2010)</td>
<td>OECD countries</td>
<td>OECD countries</td>
<td>154 countries</td>
</tr>
<tr>
<td>Mehrara et al. (2010)</td>
<td>OECD countries</td>
<td>OECD countries</td>
<td>154 countries</td>
</tr>
<tr>
<td>Woodward and Wang (2011)</td>
<td>OECD countries</td>
<td>OECD countries</td>
<td>154 countries</td>
</tr>
<tr>
<td>Liu et al. (2011)</td>
<td>OECD countries</td>
<td>OECD countries</td>
<td>154 countries</td>
</tr>
</tbody>
</table>

Health care is a necessity for 37 countries with per capita income lower than $1920 and is luxury for other countries.
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3. Data and methodology

The literature, discussed in Section 2, that has modeled the impacts of economic growth on health expenditure. The most commonly used model specification has roots in the early work of Newhouse (1977), who used a bivariate model, treating health expenditure as endogenous and income as exogenous.

\[ \ln hce_t = \alpha_i + \beta_i gdp_t + \epsilon_t \]

Here, \( hce \) is the real per capita health care expenditure in US dollar, \( gdp \) is the real per capita income in US dollar PPP terms. The term, \( \epsilon_t \), is the error term bounded with the classical statistical properties. All variables are converted in natural logarithmic form to allow us to interpret thems elasticities.

We expect an increase in income and through more emissions to positively impact health expenditures. As countries grow they have more to spend on health care, which is well known, and empirical studies support this relationship.

The empirical analysis is based on 13 developing countries: Algeria, Bahrain, Egypt, Jordan, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, Emirates, and Yemen. This sample of countries is dictated by data availability. Time series data are annual and for the period 1995–2011. The per capita health expenditures and per capita GDP are measured in US dollars at 1995 prices based on PPP.

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4 Results and discussion

4.1 Descriptive analysis:

It is fairly simple to produce these types of information from the data sets available. Remember that the descriptive analysis can often be presented more accurately for the continuous variables than for categorical variables because of lost information from collapsing it into categories. The descriptive statistics chosen include: Minimum, Maximum, Mean, and Standard Deviation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln hce</td>
<td>22</td>
<td>5.398</td>
<td>1.124</td>
<td>3.04</td>
<td>8.0</td>
</tr>
<tr>
<td>Ln gdp</td>
<td>22</td>
<td>8.461</td>
<td>1.298</td>
<td>5.84</td>
<td>11.43</td>
</tr>
</tbody>
</table>

Let’s assume that we want to look at the relationship between two variables, So the correlation is one of the most common and most useful statistics.

The correlation matrix exhibited in table 2 underlines that both variables per capita HCE and per capita GDP are firmly and positively correlated. There has been much interest in investigating correlation between HCE and GDP. Although HCE is ordinarily hypothesized to be a function of real per capita GDP, there are some reasons which this could be a bilateral relationship, as it can be reasoned that population health is an input to the macroeconomic production function. This finding indicates the relationship between per capita GDP and per capita HCE.

Table 3: Estimates for Simple Linear Regression of GDP on HCE

| Coefficient | Std. Err. | t-statistic | P(|t|) |
|-------------|-----------|-------------|-------|
| B           | .021579   | 37.33       | 0.00  |

Source: Authors’ élaboration.
The regression is estimated as follows:
\[ \ln hce = -1.41 + 0.80 \ln gdp + \varepsilon \]

Table 3 confirms the positive and significant influence of per capita GDP on per capita HCE (because P-value=0<0.05). According to result of these estimations \( \beta=0.80 \) which means that the increase of per capita GDP in one unit leads to an increase of per capita HCE in about 80%.

Coefficients are highly significant with expected signs in most cases. In particular, per capita GDP has a positive effect on health expenditure and the coefficient on the lagged endogenus is over 0.8. Sluggishness in adjustments of healthcare expenditure to income changes involves that this relationship is stronger when the observed time span increases. Both individuals and governments need time to adjust their expenditure and demand on healthcare to changes in households' income and tax revenues.

### 4.2 Hausman test

To decide between fixed or random effects we can run a Hausman test where the null hypothesis is that the preferred model is random effects, the alternative is the fixed effects. Run a fixed effects model and save the estimates, then run a random model and save the estimates, then perform the test. See below.

**Hausman fixed**

<table>
<thead>
<tr>
<th></th>
<th>(b)</th>
<th>(B)</th>
<th>sqrt(diag(V_b-V_B))</th>
<th>Fixe</th>
<th>Difference S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>lngdp</td>
<td>.6163395</td>
<td>.6673038</td>
<td>-.0509643</td>
<td>.0197647</td>
<td></td>
</tr>
</tbody>
</table>

\( b = \) consistent under Ho and Ha; obtained from xtreg

\( B = \) inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

\[ \chi^2(1) = (b-B)(V_b-V_B)^{-1}(b-B) \]

\[ = 6.65 \]

Prob>\( \chi^2 = 0.0099 \)

This is <0.05 (i.e significant) use fixed effect

The fixed-effects model controls for all time-invariant differences between the countries, so the estimated coefficients of the fixed-effects models cannot be biased because of omitted time-invariant characteristics.

### Table 4: estimates for fixed effects

|         | coefficient | Std. Err. | t-statistic | P>|t| |
|---------|-------------|-----------|-------------|------|
| lngdp   | 0.6163395   | 0.0420897 | 14.64       | 0.000 |
| Cons    | 0.1830939   | 0.3566335 | 0.51        | 0.608 |

Table 4 indicates that the first parameter (\( \alpha \)) of model is insignificant (because P-value=0.608>0.05). En outre, this table confirms the positive and significant influence of per capita GDP on per capita HCE (because P-value=0<0.05). According to result of these estimations \( \beta=0.61 \) which means that the increase of per capita GDP in one unit leads to an increase of per capita HCE in about 61.63%.

### 5 Conclusion

The contribution of this paper to the literature on the impact of healthcare expenditure and income is threefold. An important implication of our findings is that researchers and policy makers modeling health expenditures and GDP in a panel regression framework can get meaningful results that are not spurious, if structural changes are allowed. In general, earlier studies found that the overwhelming majority of the variation in HCE can be explained by variation in per-
Recently, health care economists have devoted a great deal of attention to analyzing the time series pattern of HCE and GDP.

References
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