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*

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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.

Table1: Summary of previous studies. Dependent variable: Health Care Expenditure

Authors	**Sample**	**Model desciption**	**Elasticity of income**
Newhouse (1977)	13 developed countries	Cross section	>1
Leu (1986)		Cross section	>1
Parkin et al. (1987)	19 OECD countries	Cross section	Income elasticity close to unity
Hitiris and Posnett (1992)	18 OECD countries	Panel data Income elasticity Cross section	Income elasticity close to unity
Gbesemete and Gerdtham (1992)	20 OECD countries	Time series Time series Time series Time series	No long-term relationship
Hansen and King (1996)	30 African countries	Hitiris replicated model (1997)	>1 <1 No long-term
Hitiris (1997)	20 OECD countries	Time series	relationship
Blomqvist and Carter (1997)	10 OECD countries	Time series	Long-term elasticity
McCoskey and Selden (1998)	18 OECD countries	Time series Panel data	between income and
Roberts (2000)		Panel cointegration techniques	health expenditure
Gerdtham y Lothgren (2000)	20 OECD countries	Local quantile regressions	was in almost the cases 1 >1
Okunade and Murthy (2002)	10 European countries	Panel data	>1 >1 <1
Clemente et al.(2004)	19 OECD countries	Panel data Time series	Health care is a necessity for 37 countries with per capita income lower than $ 1920 and is luxury for other countries
Sen (2005)		Semiparametric panel varying coefficient model	<1
Dregerd and Reimers (2005)	United States		
Chen, Lin and Chang (2009)	OECD countries 15 OECD countries 21 OECD countries		>1 >1
Baltagi and Moscone (2010)	154 countries		>1
Mehrara et al. (2010)			
Woodward and Wang (2011)	20		
Liu et al. (2011)	OECD countries		
	16 OECD countri		

	es United States 22 OECD countries		

Source: Authors' élaboration.

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.

$\ln hce_{it} = \alpha_i + \beta_i\, gdp_{it} + \varepsilon_{it}$

	Lnhce	Lngdp
Lnhce	**1.0000**	**0.9296**
Lngdp	**0.9296**	**1.0000**

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, ε_{it} is the error term bounded with the classical statistical properties. All variables are converted in natural logarithmic form to allow us to interpret themas 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 is well known, and empirical studies support this relationship.

The empirical analysis is based on 13 developing countries_ Algerie, Bahrein, Egypte, Jordan, Lebanon, Marok, Oman, Qatar, Saoudite, 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.

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 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Lnhce	**221**	**5.39841**	**1.124691**	**3.044523**	**8.004031**
Lngdp	**221**	**8.461758**	**1.298015**	**5.846439**	**11.43497**

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.

Table 2: Correlation Matrix

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	**.8054763**	**.021579**	**37.33**	**0.00**

				0
Cons	**-1.417336**	**.1847224**	**-7.67**	**0.000**

The regression is estimated as follows:
lnhce = -1.41 + 0.80 lngdp+ ε
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 β=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 endogenous 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 fixe

	(b) Fixe	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lngdp	.6163395	.6673038	-.0509643	.0197647

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
chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 6.65
Prob>chi2 = 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|**
B	**0.6163395**	**0.0420897**	**14.64**	**0.000**
Cons	**0.1830939**	**0.3566335**	**0.51**	**0.608**

Table 4 indicates that the first parameter (α) of model is insignificant (because P-value=0.608>0.05). En outré, 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 β=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-

capita GDP (Newhouse, 1977; Parkin et al., 1987; Gerdtham and Jonsson, 1991). Recently, health care economists have devoted a great deal of attention to analyzing the time series pattern of HCE and GDP.

References

1. Amsler, C., Lee, J., 1995. An LM test for a unit-root in the presence of a structural change. Econometric Theory 11, 359–368.
2. Blomqvist, A.G., Carter, R.A.L., 1997. Is health care really a luxury? Journal of Health Economics 16, 207–229.
3. Gerdtham, U.-G., Jonsson, B., 1991. Conversion factor instability in international comparisons of health care expenditure. Journal of Health Economics 10, 227–234.
4. Gerdtham, U.-G., Lothgren, M., 2000. On stationarity and cointegration of international health expenditure and GDP. Journal of Health Economics 19, 461–475.
5. Hansen, P., King, A., 1996. The determinants of health care expenditure: a cointegration approach. Journal of Health Economics 15, 127–137.
6. Hansen, P., King, A., 1998. Health care expenditure and GDP: panel data unit root test results—comment. Journal of Health Economics 17, 377–381.
7. Hakkio, C., 1984. A re-examination of purchasing power parity. Journal of International Economics 17, 265–277.
8. Im, K.S., Lee, J.,Tieslau, M., 2002. PanelLMUnit RootTests with Level Shifts. Mimeo, Department of Economics, University of Central Florida.
9. Im, K.S., Pesaran, M., Shin, Y., 2003. Testing for unit roots in heterogeneous panels. Journal of Econometrics, in press.
10. Hitiris, T., Posnett, J., 1992. The determinants and effects of health expenditure in developed countries. Journal of Health Economics 11, 173–181.
11. Hodrick, R.J., Prescott, E.C., 1997. Postwar U.S. business cycles: an empirical investigation. Journal of Money, Credit, and Banking 29, 1–16.
12. Im, K.S., Pesaran, M.H., Shin, Y., 2003. Testing for unit roots in heterogeneous panels. Journal of Econometrics 115, 53–74.
13. Jewell, T., Lee, J., Tieslau, M., Strazicich, M.C., 2003. Stationarity of heath expenditures and GDP: evidence from panel unit root tests with heterogeneous structural breaks. Journal of Health Economics 22, 313–323.
14. Kiviet, J.F., 1995. On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. Journal of Econometrics 68, 53–78.
15. Leu, R.E., 1986. The public–private mix and international health care costs. In: Culyer, A.J., Jonsson, B. (Eds.), Public and Private health services. Basil Blackwell, Oxford.
16. Levin, A., Lin, C.-F., Chu, C.-S.J., 2002. Unit root tests in panel data: asymptotic and finite sample properties. Journal of Econometrics 108, 1–24.
17. Liu,D., Li,R.,Wang,Z., 2011.Testing for structural breaks in panel varying coefficientmodels: with an application to OECD health expenditure. Empirical Economics 40 (1), 95–118.
18. Mehrara, M., Musai, M., Amiri, H., 2010. The relationship between health expenditure and GDP in OECD countries using PSTR. European Journal of Economics, Finance and Administrative Sciences 24, 1450–2275.
19. Newhouse, J.P., 1977. Medical care expenditure: a cross-national

survey. Culyer: The Economics of Health, vol. 2
20. Nickel, S., 1981. Biases in dynamicmodels with fixed effects. Econometrica 49, 1417–1426. OECD, 2012. OECD Health Data File 2011.
21. Okunade, A.A., Murthy, V.N.R., 2002. Technology as a "major driver" of health care costs: a co integration analysis of the Newhouse conjecture. Journal of Health Economics 21 (1), 147–159.
22. Parkin, D., Mcguire, A., Yule, B., 1987. Aggregate health care expenditures and national income. Journal of Health Economics 6, 109–127.
23. Ravn, M.O., Uhlig, H., 2002. On adjusting the Hodrick–Prescott filter for the frequency of observations. The Review of Economics and Statistics 84, 371–375.
24. Sen, A., 2005. Is health care a luxury? New evidence from OECD Data. International Journal of Health Care Finance and Economics 5, 147–164.
25. Sood, N., Ghosh, A., Escarse, J.J., 2007. The Effect of Health Care Cost Growth on the U.S. Economy. Office of the Assistant Secretary for Planning and Evaluation (ASPE), U.S. Department of Health and Human Services (HHS).
26. Dickey, D., Fuller, W., 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association 74, 427–431.
27. Enders, W., 1995. Applied Econometric Time Series. Wiley, New York. Gerdtham, U.G., Jonsson, B., 1991a. Price and quantity in international comparisons of health care expenditure. Applied Economics 23, 1519–1528.
28. Gerdtham, U.G., Jonsson, B., 1991b. Conversion factor instability in international comparisons of health care expenditure. Journal of Health Economics 10, 227–234.
29. Gerdtham, U.G., Lothgren, M., 2000. On stationarity and cointegration of international health expenditure and GDP. Journal of Health Economics 19 (4), 461–475.
30. Granger, C.W.J., 1969. Investigating causal relations by econometric models and crossspectral models. Econometrica 37, 424–438.
31. Hansen, P., King, A., 1996. The determinants of health care expenditure: a cointegration approach. Journal of Health Economics 15, 127–137.
32. Hitiris, T., Posnett, J., 1992. The determinants and effects of health expenditure in developed countries. Journal of Health Economics 11, 173–181.
33. Jewell, T., Lee, J., Tieslau, M., Strazicich, M.C., 2003. Stationarity of health expenditures and GDP: evidence from panel unit root tests with heterogeneous structural breaks. Journal of Health Economics 22, 313–323.
34. Karatzas, G., 2000. On the determination of the USA aggregate health care expenditure. Applied Economics 32, 1085–1099.
35. Konya, L., 2000. Export-led growth or growth-driven export? New evidence from Granger causality analysis on OECD countries. Central European University, Department of Economics, Working Paper 15.
36. Kuzozumi, E., Yamamoto, T., 2000. Modified lag augmented autoregressions. Economic Review 19, 207–231.
37. Mavrotas, G., Kelly, R., 2001. Old wine in new bottle: testing causality between savings and growth. The Manchester School Supplement 97–105.

38. McCoskey, S.K., Selden, T.M., 1998. Health care expenditures and GDP: panel data unit root test results. Journal of Health Economics 17 (3), 369–376.
39. Milne, R., Molana, H., 1991. On the effect of income and relative price on demand for health care: EC evidence. Applied Economics 23, 1221–1226.
40. Murthy, N.R.V., Ukpolo, V., 1994. Aggregate health care expenditure in the United States: evidence from cointegration tests. Applied Economics 26 (8), 797–802.
41. Newhouse, J.P., 1987. Cross-national differences in health spending: what do they mean? Journal of Health Economics 6, 159–162.
42. Parkin, D., McGuire, A., Yule, B., 1987. Aggregate health care expenditures and national incomes: is health care a luxury good? Journal of Health Economics 6, 109–127.
43. Rambaldi, A.N., 1997. Multiple time series models and testing for causality and exogeneity: a review. Working Papers in Econometrics and Applied Statistics, No. 96. Department of Econometrics, University of New England, Arnidale, Australia.
44. Rambaldi, A.N., Doran, H.E., 1996. Testing for Granger non-causality in cointegrated system made easy. Working Papers in Econometrics and Applied Statistics, No. 88. Department of Econometrics, University of New England, Arnidale, Australia.
45. Roberts, J., 2000. Spurious regression problems in the determinants of health care expenditure: a comment on Hitiris (1997). Applied Economics Letters 7, 279–283.
46. Smith, J., 1999. Healthy bodies and thick wallets: the dual relation between health and economic status. The Journal of Economic Perspectives 13 (2), 145– 166.
47. Toda, H.Y., Yamamoto, T., 1995. Statistical inference in vector autoregressions with possibly integrated processes. Journal of Econometrics 66, 225–250.
48. Ventelou, B., Arrighi, Y., Greener, R., Lamontagne, E., Carrieri, P., Moatti, J.P., 2012. The macroeconomic consequences of renouncing to universal access to antiretroviral treatment for HIV in Africa. PLoS ONE 7, e34101.
49. Wolde-Rufael, Y., 2004. Disaggregated industrial energy consumption and GDP: the case of Shanghai, 1952–1999. Energy Economics 26 (1), 69–75.
50. Wolde-Rufael, Y., 2005. Energy demand and economic growth: the African experience. Journal of Policy Modeling 27, 891–903.
51. Wolde-Rufael, Y., 2006. Electricity consumption and economic growth: a time series experience for 17 African countries. Energy Policy 34 (10), 1106–1114.
52. Zapata, H.O., Rambaldi, A.N., 1997. Monte Carlo evidence on cointegration and causation. Oxford Bulletin of Economics and Statistics 59, 285–298