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ON THE RELATIONSHIP BETWEEN GDP AND HEALTH CARE EXPENDITURE: A NEW PERSPECTIVE(*)

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ABSTRACT

In this paper we analyze the relationship between income and health expenditure in 31 OECD countries. We focus on the difference between short and long term multipliers and we also check the adjustment process of health care expenditure to changes in per capita GDP and its main components. In both cases we test if results differ in countries with a higher share of private expenditure on total health expenditure. Econometric results show that the long-run multiplier is close to unity, that health expenditure is more sensitive to per capita income cyclical movements than to trend movements, and that those countries with a higher share of private health expenditure fit faster and following a different pattern.

Keywords: GDP, Health care expenditure, OECD, panel data, income elasticity.

JEL Classification: H51, I1, I18, I38.

1. INTRODUCTION

In this paper we examine the relationship between per capita national income and health expenditure using an unbalanced panel for 31 OECD (Organization for Economic Cooperation and Development) countries over the period 1970-2009. Attention is paid to several usually neglected dimensions of this link. With this aim, four different specifications are presented, with the logarithm of per capital total health care expenditure as the dependent variable in all cases.

First, we analyze the relationship between health expenditure and income by means of a dynamic regression model, with lagged values of the endogenous variable as right-hand side variables, in order to compute both short-run and long-run income elasticities.

Second, we check if parameter estimates of the basic model are significantly different for those countries where the share of private choices on health expenditure over the total is higher. Insofar as private and public choice processes are not the same, it might be expected different patterns in the relationship between income and expenditure depending on the relative relevance of public and private choices on health care expenditure in each country.

Third, the observed changes in per capita GDP (Gross Domestic Product) are decomposed to check if the elasticity of health care expenditure is similar for changes in per capita GDP trend, positive gaps, and negative gaps. Gaps are defined here as the difference between observed values and the trend component computed using the Hodrick-Prescott filter. Finally, we discuss if those results hold again in countries where private expenditure outweighs over the total.

The plan of the paper is as follows. Section 2 reviews the literature up to date. Section 3 describes the data, while Section 4 discusses methodological issues. Section 5 details the main results. Section 6 concludes.

2. PREVIOUS EVIDENCE

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 health expenditure and per capita income in developed countries, but also that per capita income explains a high percentage of the variation in per capita health expenditure.

Over the last few years the debate on this link has moved on whether the income elasticity of health expenditure is greater or less than 1 (Bac and Le Pen, 2002). An income elasticity less than 1 classified health expenditure 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. Naturally, all this means that if the elasticity is higher than 1, national health expenditure would increase faster than income, while if it is less than 1, health expenditure would increase more slowly than income. In summary, the empirical literature on the determinants of national health expenditure shows that aggregate income is one of the most important factors in explaining health expenditure. But income elasticity changes depend on the study, as shown in Table 1.

The empirical literature on the determinants of health care expenditure started with the seminal paper by Newhouse (1977), and a debate has raged over the income elasticity of demand, the central question being whether health expenditures increase faster than per capita income. The author examined the relationship between medical care expenditure and income across 13 developed countries, regressing per capita medical care expenditures on per capita GDP. Linked with an earlier study by Kleiman (1974) for a different set of countries, Newhouse reached the conclusion that the income elasticity of medical care expenditures across countries exceeds one - by definition this implies that, at the margin, medical care is a luxury good. He felt that in countries with high expenditure, the marginal unit of medical care is more likely to produce improvements in so-called subjective components of health, such as relief of anxiety and more accurate diagnoses, rather than improvements in morbidity and mortality rates.

After, Leu (1986) found elasticities ranging from 1.18 to 1.36 using cross-sectional data for 19 OECD countries in 1974 and Parkin *et al*. (1987) using similar methods and data from 1980 found income

elasticities of 1.12 to 1.18. While, Brown (1987) using a sample of 20 OECD countries estimated an income elasticity of 1.39.

Other authors like Gbesemete and Gerdtham (1992) estimated the impact of per capita income in per capita health expenditure and the estimated coefficient for per capita income was statistically significant and approximately equal to unity with data from 1984 for 30 African countries. In the same year, Gerdtham *et al.* (1992a and b) carried out a similar exercise using 1987 data from 19 OECD countries, authors found an income elasticity of 1.33.

Also, in Hitiris and Posnett (1992) with a panel data model for 20 OECD countries in 1960-1987, found a strong positive relationship between per capita health expenditure and income alike with previous studies, with an income elasticity close to the unit. Later, Hitiris (1997) with data for 10 OECD countries over the period 1960-1991 showed that income elasticity of health expenditure ranges from 1.14 to 1.17.

As Barros (1998) points out, we need to consider growth differences between countries, but not levels. Basically, using the same variables got different results. The generally health care system characteristics that were thought to affect the growth of health expenditure, such as aging, type of health system and the existence of gateway to the system were not significant. The only exception was the income variable with a low elasticity but close to unity.

Whereas, Gerdtham *et al.* (1998) found against to other studies, an income elasticity below to one (0.74) using a panel data model for 22 OECD countries over the period 1970-1991 and including variables as the number of per capita doctors and the regulatory framework of each country.

Another author, Roberts (2000) used data from 10 European countries for the period 1960-1993 replicated Hitiris model (1997) and found a high degree of stationarity in the data, which allowed him to argue that there was a problem of spurious regression in Hitiris model. He also found that long-term elasticity between income and health expenditure was in most of the cases 1.

Recent information from 1990 to 1998 for 15 OECD countries was used in Sen (2005) to assess the relationship between per capita income and health expenditure. These data allows the author to control the effects of various noninstitutional demand and supply covariance introducing new variables of cost or supply. The results were income elasticities of health expenditure between 0.21 and 0.51.

While, Dregerd and Reimers (2005) using panel cointegration techniques, and data from 21 OECD countries determined too that health care expenditures are not only determined by income. Another of theirs conclusions is that health care expenditure is not a luxury good.

Chakroun (2009) derive country-specific and time-specific income elasticities for 17 OECD countries over the period 1975-2003 using a panel threshold regression model. His results show that health care is a necessity rather than a luxury. Further, the relationship between health expenditure and income seems rather nonlinear, changing over time and across countries. Meanwhile, Chen, Lin and Chang (2009), using local quantile regressions for 154 countries, realized that health care is a necessity good for countries with per capita income lower than $1920.

Using data for 20 OECD countries, Baltagi and Moscone (2010), studied the non-stationarity and cointegration properties between health care expenditure and income; their findings suggest that health care 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 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 health expenditure 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 expenditure. They found a full-sample income elasticity of 1.603, in line to the results found by Woodward and Wang (2011) for the US national health care expenditures.

These authors note that the 'curve' defined by the log of US national health care expenditures per capita plotted against the log of the US gross domestic product per capita has been remarkably straight since 1929 despite Medicare and Medicaid and all of the more recent reform attempts.

After establishing stationarity and considering cointegration and endogeneity, the slope of this log-log relationship suggests a per capita expenditure-income elasticity of 1.388. Woodward and Wang suggest two explanatory hypotheses about it. First, many new technologies are endogenous because their introduction is determined by their expected market, which is in turn dependent on GDP per capita. Second, the authors emphasize the potential utility gained by spending disproportionately larger proportions of growing income on hope, uncertainty-reducing information, and consumer amenities, all of which may be independent of any improved health outcome.

In short, most of the studies summarized in Table 1 find a positive income elasticity for national health care expenditure, but they do not reach a consensus on whether health care is a "necessary" (or a "luxury"**)** good. While we are also interested on the value of this elasticity, we try to bring to the discussion the relevance of distinguishing between short-run and long-run dynamics, the nature of changes in per capita GDP growth rates (structural or cyclical), and the different logics of private and public choices on health care expenditure.

Table 1

A SUMMARY OF PREVIOUS STUDIES. DEPENDENT VARIABLE: NATIONAL HEALTH CARE EXPENDITURE

AUTHORS	SAMPLE	MODEL DESCRIPTION	ELASTICITY OF INCOME
Newhouse (1977)	13 developed countries	Cross section	>1
Leu (1986)	19 OECD countries	Cross section	>1
Parkin *et al.* (1987)	18 OECD countries	Cross section	>1
Hitiris and Posnett (1992)	20 OECD countries	Panel data	Income elasticity close to unity.
Gbesemete and Gerdtham (1992)	30 African countries	Cross section	Income elasticity close to unity
Hansen and King (1996)	20 OECD countries	Time series	No long-term relationship
Blomqvist and Carter (1997)	18 OECD countries	Time series	<1
Hitiris (1997)	10 OECD countries	Time series	>1
McCoskey and Selden (1998)	20 OECD countries	Time series	No long-term relationship.
Roberts (2000)	10 European countries	Hitiris replicated model (1997)	Long-term elasticity between income and health expenditure was in almost the cases 1
Gerdtham y Lothgren (2000)	19 OECD countries	Time series	>1
Okunade and Murthy (2002)	United States	Time series	>1
Clemente *et al.* (2004)	OECD countries	Time series	>1
Sen (2005)	15 OECD countries	Panel data	<1
Dregerd and Reimers (2005)	21 OECD countries	Panel cointegration techniques	<1
Chakroun (2009)	17 OECD countries	Multivariate regression model	<1
Chen, Lin and Chang (2009)	154 countries	Local quantile regressions	Health care is a necessity for 37 countries with per capita income lower than $ 1920 and is luxury for other countries
Baltagi and Moscone (2010)	20 OECD countries	Panel data	<1
Mehrara, Musai and Amiri (2010)	16 OECD countries	Panel data	>1
Woodward and Wang (2011)	United States	Time series	>1
Liu, Li and Wang (2011)	22 OECD countries	Semiparametric panel varying coefficient model	>1

Source: Authors' elaboration.

3. DATA DESCRIPTION

The econometric analysis relies on annual data for 31 OECD countries from 1970 to 2009 gathered from the OECD Health Data Set 2011. The OECD Health Data is the largest available[1] source of statistics to compare OECD health care systems. So, this database allows doing benchmarking and international comparisons of different health systems (see Annex). In Table 2 definitions and data sources of variables are depicted. Table 3 summarizes the basic descriptive statistics of variables using stacked data and Table 4 summarizes country information on the share of private expenditure on total health care expenditure. It also contains the mean of the out-of-pocket payments by country and the nature of its health care system[2]. These out-of-pocket payments comprise, as OECD definition, cost-sharing (relates to provisions of health insurance on third-party payers like copayments or moderator ticket), self-medication and other expenditure paid directly by private households.

Information on per capita total health care expenditure and per capita GDP expressed in current prices and logarithms are collected. We also use *OLD*, the percentage of population aged over 64, identified by the literature as having a role in determining health care expenditure. Two additional comments on variables are needed. First, the definition of variable *DPRIV* is based on data. The share of private expenditure over the total is systematically over 40% in the six countries where *DPRIV=1* (See Table 4). A cluster analysis on means and medians in Table 4 formally supported this criteria and the consequent grouping of countries. Second, following the proposal by Hoddrick and Prescott (1997) for annual data, the smoothing parameter used to estimate the trend component of *GDP* is λ=100. We have checked that econometric results below do not significantly change if λ=6.25, following to Ravn and Uhlig (2002). Once *GDPTREND* is estimated, *POSGAP* and *NEGGAP* are computed as indicated in Table 2.

Table 2

VARIABLES AND DATA SOURCES

	Definition	Data Source
EXP	Per capita total health care expenditure. Expressed in current prices and logarithms	OECD Health Data (2011)
GDP	Per capita Gross Domestic Product. Expressed in current prices and logarithms	OECD Health Data (2011)
DPRIV	Dummy variable coded 1 for observations corresponding to the US, Switzerland, Chile, Mexico, Korea, and Greece and 0 otherwise	Authors' elaboration
GDPTREND	The smoothed series of GDP computed using the Hodrick-Prescott (HP) filter	Authors' elaboration
POSGAP	It is defined as GDP-GDPTREND when GDP>GDPTREND and 0 otherwise	Authors' elaboration
NEGGAP	It is defined as GDP-GDPTREND when GDP≤GDPTREND and 0 otherwise	Authors' elaboration
OLD	Percentage of population over 64 years old	OECD Health Data (2011)

Source: Authors' elaboration.

Table 3

DESCRIPTIVE STATISTICS. STACKED DATA

	Mean	Median	Standard Deviation	Maximum	Minimum
EXP	6.8963	7.0157	0.9314	8.9277	3.6888
GDP	9.5467	9.6305	0.6858	10.9784	7.5448
DPRIV	0.1672	0.0000	0.3733	1.0000	0.0000
GDPTREND	9.5458	9.6417	0.6834	10.9443	7.5863
POSGAP	0.0108	0.0000	0.0162	0.0926	0.0000
NEGGAP	-0.0099	-0.0005	0.0148	0.0000	-0.1278
OLD	12.7480	13.2000	3.4097	21.5000	3.8000

Source: Authors' elaboration based on OECD Health Data (2011).

[1] It is a public database, but the access to the full data is via subscription.

[2] Social Security (SS), National Health System (NHS), Private or Mixed system.

Table 4

THE SHARE OF PRIVATE EXPENDITURE ON TOTAL HEALTH EXPENDITURE

Country	Mean	Median	Maximum	Minimum	Observations[3]	Out-of-pocket payments[4]	Type of model
Australia	0.34	0.34	0.41	0.26	37	16.34	NHS
Austria	0.27	0.25	0.37	0.23	39	15.64	SS
Belgium	0.25	0.25	0.27	0.24	8	20.35	SS
Canada	0.27	0.26	0.3	0.23	40	15.12	NHS
Chile	0.47	0.46	0.53	0.41	14	D.N	Mixed
Czech Republic	0.09	0.1	0.17	0.03	19	8.92	SS
Denmark	0.16	0.16	0.18	0.12	37	14.47	NHS
Finland	0.24	0.25	0.29	0.19	39	19.85	NHS
France	0.22	0.21	0.24	0.2	23	9.40	SS
Germany	0.22	0.22	0.27	0.18	38	11.17	SS
Greece	0.44	0.45	0.57	0.38	23	D.N	NHS
Hungary	0.23	0.27	0.31	0.11	18	20.61	Mixed
Iceland	0.16	0.16	0.34	0.1	39	16.03	NHS
Ireland	0.24	0.24	0.29	0.17	39	15.11	NHS
Italy	0.25	0.24	0.3	0.21	22	21.84	NHS
Japan	0.24	0.24	0.34	0.17	38	15.97	SS
Korea	0.62	0.64	0.8	0.45	29	53.98	SS
Luxembourg	0.09	0.1	0.12	0.07	12	7.02	SS
Mexico	0.55	0.55	0.59	0.52	20	52.86	SS
Netherlands	0.32	0.32	0.4	0.26	31	7.41	SS
New Zealand	0.2	0.22	0.26	0.05	39	14,35	NHS
Norway	0.13	0.15	0.19	0.02	39	15,59	NHS
Poland	0.27	0.28	0.35	0.08	19	25,85	SS
Portugal	0.37	0.37	0.49	0.27	37	22,39	NHS
Slovak Republic	0.18	0.11	0.33	0.08	12	15,88	SS
Spain	0.25	0.24	0.35	0.15	39	21,96	NHS
Sweden	0.13	0.13	0.18	0.07	39	15,83	NHS
Switzerland	0.45	0.45	0.5	0.4	25	33,47	SS
Turkey	0.4	0.33	0.78	0.28	26	25,51	SS
UK	0.15	0.16	0.21	0.09	39	11,90	NHS
US	0.58	0.59	0.64	0.53	39	20,21	Private

Note: Social Security (SS), National Health System (NHS), Private or Mixed system. Source: Authors' elaboration base on OECD Health Data (2011).

[3] The available data in OECD Health Data 2011 sample in countries like Belgium, Czech Republic, Luxembourg and the Slovak Republic is smaller than for the rest of the OECD countries studied. This may be because in these four countries the available data on health expenditure and health financing in which the OECD is based to develop the database is more recent.

[4] Mean as a share of total health care expenditure.

4. SPECIFICATIONS AND ECONOMETRICS

Specifications

The first specification includes as regressors the lagged dependent variable, *GDP*, and *OLD*. Insofar as population brackets tend to be highly correlated, multicollinearity is troublesome when they are simultaneously included (Cantarero and Lago-Peñas, 2012). This is the reason why *OLD* is the only demographic variable added as control. Specification [1] also includes individual fixed effects. The short-run multiplier of income on health care expenditure is β and the long-run multipler is $\frac{\beta}{1-\rho}$:

$$EXP_{it} = \alpha_i + \rho \cdot EXP_{it-1} + \beta \cdot GDP_{it} + \delta \cdot OLD + \varepsilon_{it} \quad [1]$$

Specification [2] extends [1] to check if parameters for EXP_{-1} and *GDP* are different for countries with a lower ratio between public and total health care expenditure. For those countries *DPRIV*=1 and then the effect of EXP_{-1} is $\rho_1 + \rho_2$ and the effect of *GDP* is $\beta_1 + \beta_2$:

$$\begin{aligned} EXP_{it} = \alpha_i + \rho_1 \cdot EXP_{it-1} + \rho_2 \cdot EXP_{it-1} \cdot DPRIV_i + \\ + \beta_1 \cdot GDP_{it} + \beta_2 \cdot GDP_{it} \cdot DPRIV_i + \delta \cdot OLD + \varepsilon_{it} \end{aligned} \quad [2]$$

Specification [3] extends [1] disaggregating *GDP* into the trend, the positive gap, and the negative gap: $GDP_{it} = GDPTREND_{it} + POSGAP_{it} + NEGGAP_{it}$

$$\begin{aligned} EXP_{it} = \alpha_i + \rho \cdot EXP_{it-1} + \beta_3 \cdot GDPTREND_{it} + \\ + \beta_4 \cdot POSGAP_{it} + \beta_5 \cdot NEGGAP_{it} + \delta \cdot OLD + \varepsilon_{it} \end{aligned} \quad [3]$$

Finally, specification [4] combines specification [2] and [3] to test the existence of asymmetries between groups of countries also in the effect of the filtered components of variable *GDP*.

$$\begin{aligned} EXP_{it} = \alpha_i + \rho \cdot EXP_{it-1} + \beta_3 \cdot GDPTREND_{it} + \beta_4 \cdot POSGAP_{it} + \\ + \beta_5 \cdot NEGGAP_{it} + \beta_6 \cdot GDPTREND_{it} \cdot DPRIV_i + \\ + \beta_7 \cdot POSGAP_{it} \cdot DPRIV_i + \beta_8 \cdot NEGGAP_{it} \cdot DPRIV_i + \delta \cdot OLD + \varepsilon_{it} \end{aligned} \quad [4]$$

Econometrics

As usual when working with time series, the first step is to analyze the data generator process of variables in order to detect and avoid the problem of spurious regressions. In particular we are interested in the existence of unit roots in the level of series *GDP* and *EXP* and, if this is the case, if they are cointegrated or not. With this aim, two unit root tests for panel data have been carried out. The test developed by Levin-Lin-Chu (2002) or LLC, assumes that each individual unit in the panel shares the same AR(1) coefficient. On the contrary, the test by Im, Pesharan and Shin (2003) or IPS allow for different AR(1) coefficients in each series. Both tests assume that all series are non-stationary under the null hypothesis. A summary of results is reported in Table 5. The null hypothesis is clearly rejected in all cases. Both series may be treated as I(0) or stationary.

Table 5
UNIT ROOT TESTS. TSCS DATA

Variable	LLC	IPS	Observations
EXP	-15.3 (p-value<0.0001)	-4.43 (p-value<0.0001)	942
GDP	-23.5 (p-value<0.0001)	-11.81 (p-value<0.0001)	1086

Notes: Individual intercepts included in test equations. Null hypothesis LLC: Unit root (assumes common unit root process). Null hypothesis IPS: Unit root (assumes individual unit root process). Source: Authors' elaboration.

Results from preliminary estimates of equation [1], not reported in the paper, revealed a number of problems to deal with:

1. Both the lagged endogenous and the individual fixed effects were highly significant.
2. Residuals suffered from first-order autocorrelation.
3. Residuals revealed group-wise heteroskedasticity and cross-sectional dependence.

As is well know, the Least Square Dummy Variable (LSDV) estimator is biased when the lagged endogenous is included as regressor (Nickel, 1981). Insofar as the bias is of O(1/T) it is troublesome when T is small. However, we are working with TSCS with T up to 40, involving that biases tend to fade. In fact, according to the Monte Carlo results presented by Beck and Katz (2009), with T=20 or more, LSDV performs relatively well and is flexible enough to allow other estimation problem to deal with, as in our case. By contrast, the Kiviet correction (Kiviet, 1995), extended to unbalanced dataset by Bruno (2005), works better in terms of bias and the root mean square error (RMSE), but does not report analytical standard errors. Only bootstrap standard errors are reported.

LSDV errors were serially correlated (p-value<0.01) based on the results from the Breusch-Godfrey serial correlation LM test. Because the lagged endogenous is also included as regressor, OLS or non-iterated versions of more sophisticated estimators (Cochrane-Orcutt, Prais-Winsten, Hatanaka…) are not consistent. Nevertheless, Nonlinear Least Squares (NLLS) estimates are asymptotically equivalent to maximum likelihood estimates and are asymptotically efficient. The coefficients on the exogenous variables and the lagged dependent variables are then estimated simultaneously by applying a Marquardt NLLS algorithm following an iterative procedure.

Following Greene (1997), we calculated a modified Wald statistic for groupwise heteroskedasticity in the residuals. According to the results, the null hypothesis of homoskedasticity can be rejected (p-value < 0.0001). Moreover, we have computed the Breusch-Pagan statistic for cross-sectional independence in the residuals of a fixed effect regression model (Greene, 1997, p. 601). The null hypothesis can be rejected (p-value<0.0001). Hence, OLS standard errors are replaced by Panel Corrected Standard Errors (PSCE) proposed by Beck and Katz (1995) robust to both cross-sectional heteroskedasticity and contemporaneous correlation in residuals.

5. RESULTS

The estimation of the four specifications described yielded the results reported in Table 6. The goodness of fit is very high in all cases. Coefficients are highly significant with expected signs in most cases. In particular, per capita GDP has a positive effect on health expenditure.

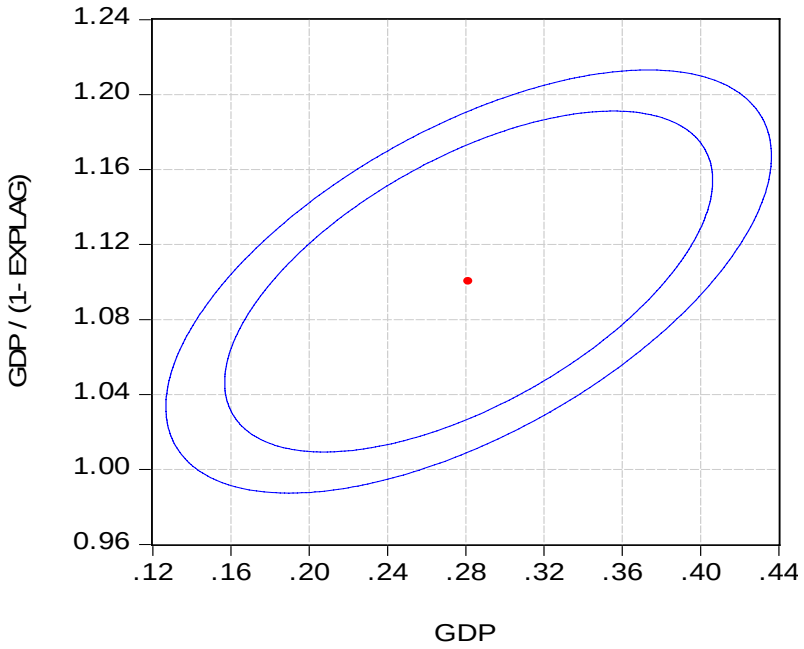
According to econometric estimates for specification [1], while the estimated short-run multiplier $\left(\hat{\beta}\right)$ is around 0.3, the long-run multiplier $\left(\frac{\hat{\beta}}{1-\hat{\rho}}\right)$ is 1.1. However, the unitary long-run multiplier is inside the confidence ellipse at 99% (Figure 1)[5]. That means that the hypothesis $\frac{\beta}{1-\rho}=1$ can be rejected at 95% but not at 99% level of confidence.

[5] A confidence ellipse plots the joint confidence region of two functions of estimated parameters.

Figure 1

ESTIMATED CONFIDENCE ELLIPSES FOR COEFFICIENTS β AND $\frac{\beta}{1-\rho}$

IN SPECIFICATION [1] ESTIMATED IN COLUMN [1] OF TABLE 6



Note: Confidence ellipses at 95% and 99% are reported.

According to the results for specification [2], health care systems with a higher share of private expenditure over total health care expenditure adjust faster to per capita GDP changes. All in all, income elasticity is not significantly higher in the long term: a positive value for β_2 is compensated by a negative value for ρ_2.

There is a high level of consensus among researchers and decision makers operating in the health sector about the importance of evaluating the impact of time (technological progress in health care and its impact on quality of the services provided), but there is no such consensus concerning how to implement it. In this sense, in the third column of Table 6 a time trend is added to specification [2] in order to check the sensitivity of results to specification problems; in particular, biases due to the omission of relevant variables. As discussed in Cantarero and Lago-Peñas (2010), including a time trend is usual to proxy for technological progress in health care. All results hold except in the case of variable *OLD*. Due to its collinearity with the time trend, its statistical significance drops below usual levels.

Results for specification [3] show that health expenditure tends to be more sensitive to per capita income cyclical movements than to trend movements. Nevertheless, a Wald test confirms that the difference between the response in times of positive and negative cyclical per capita GDP component is not statistically significant.

An alternative and straightforward solution is that things are different when attention is focused on countries with a stronger role of private expenditure in health care (last column of Table 6). Those countries tend to be more sensitive to changes in per capita GDP growth trend. Similar result is shown for the US case in Sood *et al.* (2007). This could be because sectors such as health and education compete for allocation of funds so that an increase in health expenditures is accompanied by a similar increase in several other sectors. Moreover, a Wald test confirms that they are insensitive to changes in the cyclical component of per capita GDP when it is positive. Finally, another Wald test shows that they are much more sensitive than the rest of countries to the cyclical component when it is negative: the higher the relevance of public over total outlays, the higher the rigidity to adjust health care expenditure.

Table 6
ECONOMETRIC ESTIMATES OF SPECIFICATIONS [1] TO [4]

Variables	Specification				
	[1]	[2a]	[2b]	[3]	[4]
EXP_{-1}	0.74***	0.75***	0.72***	0.81***	0.82***
	(17.84)	(17.34)	(14.42)	(22.78)	(21.56)
GDP	0.28***	0.27***	0.24***		
	(5.53)	(5.14)	(4.56)		
EXP_{-1}*DPRIV		-0.11*	-0.13**		-0.12
		(1.92)	(2.26)		(2.00)**
GDP*DPRIV		0.19**	0.22***		
		(2.41)	(2.76)		
GDPTREND				0.19***	0.19***
				(4.32)	(4.04)
POSGAP				0.34**	0.43**
				(2.14)	(2.42)
NEGGAP				0.63***	0.53***
				(3.72)	(2.77)
GDPTREND*DPRIV					0.20**
					(2.33)
POSGAP*DPRIV					-0.63**
					(2.27)
NEGGAP*DPRIV					0.59*
					(1.81)
OLD	0.0046**	0.0043**	0.0022	0.0036**	0.0035**
	(2.25)	(2.13)	(1.19)	(2.02)	(2.01)
AR(1)	0.36***	0.35***	0.37***	0.27***	0.26***
	(4.77)	(4.66)	(4.55)	(3.85)	(3.72)
Time trend			0.0038**		
			(2.28)		
Wald test: GDPPOSGAP = GDPNEGGAP				p-value=0.28	p-value=0.72
Wald test: GDPPOSGAP + GDPPOSGAP *DPRIV=0					p-value=0.40
Wald test: = GDPNEGGAP +GDPNEGGAP*DPRIV=1					p-value=0.64
Adjusted-R^2	0.998	0.998	0.998	0.998	0.998
Number of observations (unbalanced panel)	916	916	916	916	916

Notes: All specifications are estimated by NLLS. Estimates include individual fixed effects. t-statistics computed using PCSE in parenthesis. *Significant at 10%. **Significant at 5%. ***Significant at 1%. Wald tests are computed using PCSE. All the estimates were performed using EViews 7.2. Source: Authors' elaboration.

6. CONCLUSIONS

In this paper we analyze the relationship between income and health expenditure using data from the OECD Health data (2011) for 31 OECD countries observed over the period 1970-2009. The contribution of this paper to the literature is threefold. First, we analyze the dynamics of the relationship and in particular, the difference between short and long term multipliers. Second, we analyze whether the

response of health expenditure is similar when there occur changes in per capita GDP trend or in the gap between the observed per capita GDP and the trend GDP. Third, we test if relationships are different in the case of countries where private expenditure outweighs over the total.

Using data from the OECD and a methodology of Nonlinear Least Squares, four econometric specifications are estimated. Our results show that health expenditure is more sensitive to per capita income cyclical movements than to trend movements. According to econometric estimates, while the estimated short-run multiplier is around 0.3, the long-run multiplier is 1.1 although about the unitary long-run multiplier means that can be rejected at 95% but not at 99% level of confidence. Second, differences between the response in times of positive and negative output gaps is not statistically significant. Third, countries with a higher private share in total health care expenditure adjust faster to changes in GDP but income elasticity is not significantly higher in the long term. Similar result is shown for the US case in Sood *et al.* (2007).

Expenditure in those countries are more sensitive to changes in per capita GDP growth trend, is insensitive to changes in the positive output-gap, but it is very sensitive to changes in negative output gaps: the higher the relevance of public over total outlays, the higher the rigidity to adjust expenditure.

ANNEX

Figure A.1
RELATIONSHIP BETWEEN *GDP* AND *EXP* 1970-2010

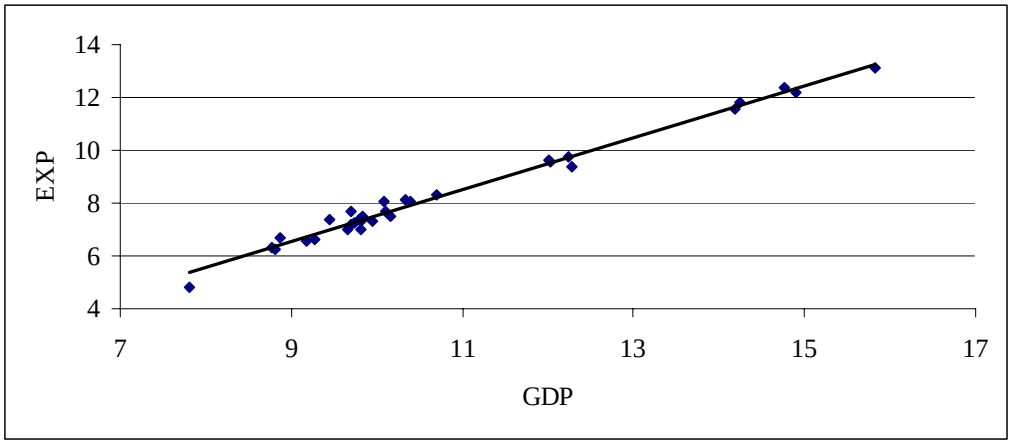


Figure A.2
RELATIONSHIP BETWEEN *GDP* AND *EXP* 1970-2010 MEAN OECD (31 COUNTRIES)

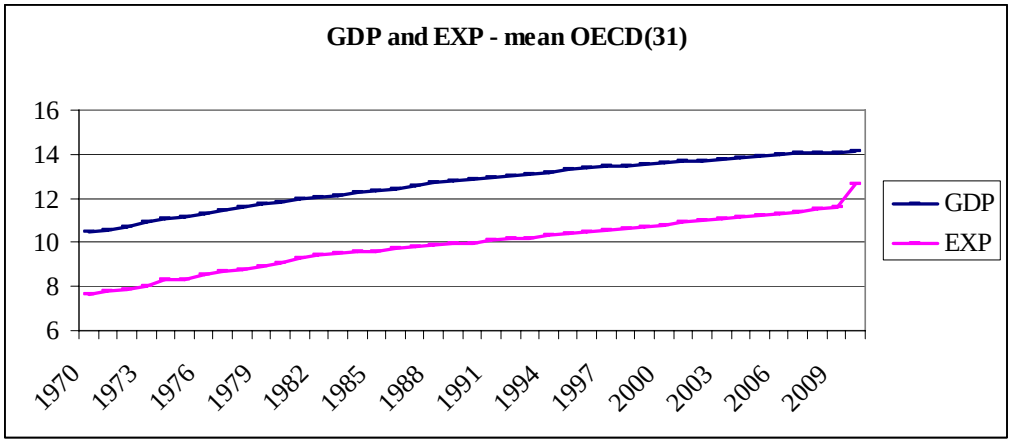


Figure A.3
RELATIONSHIP BETWEEN *GDP* AND *EXP* 1970-2010 UNITED STATES

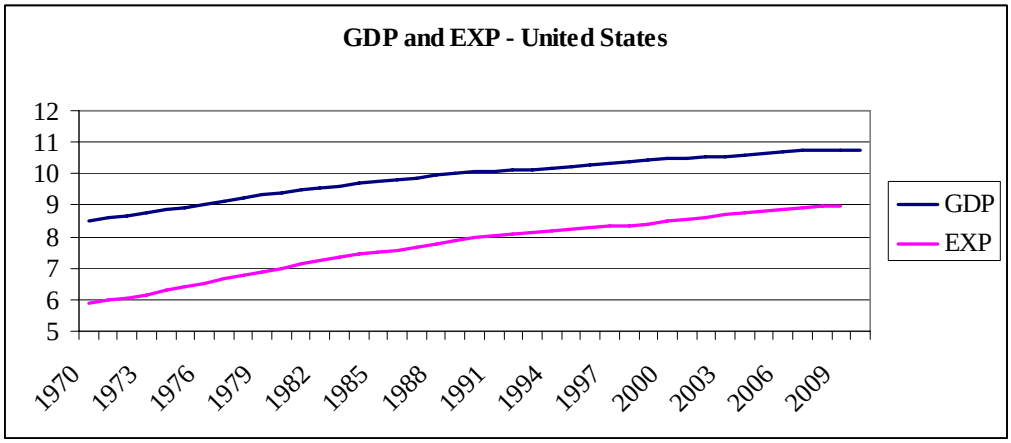


Figure A.4
RELATIONSHIP BETWEEN *GDP* AND *EXP* 1970-2010 MEAN NHS

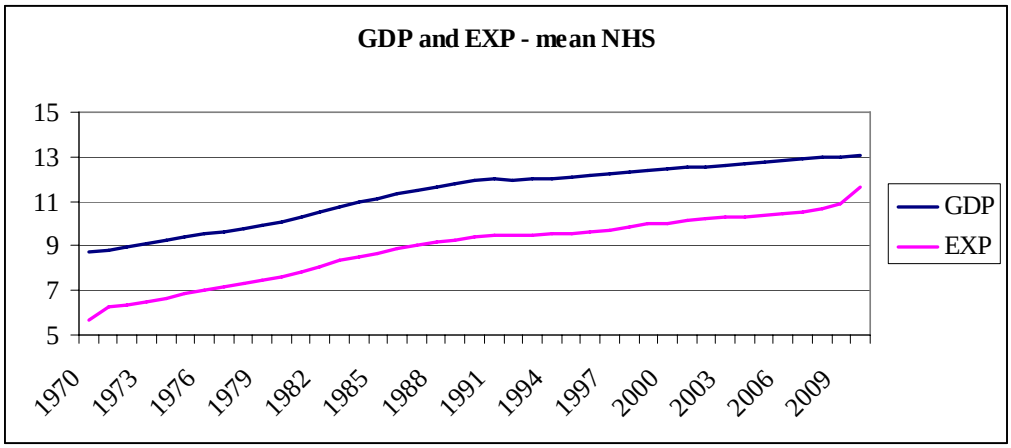
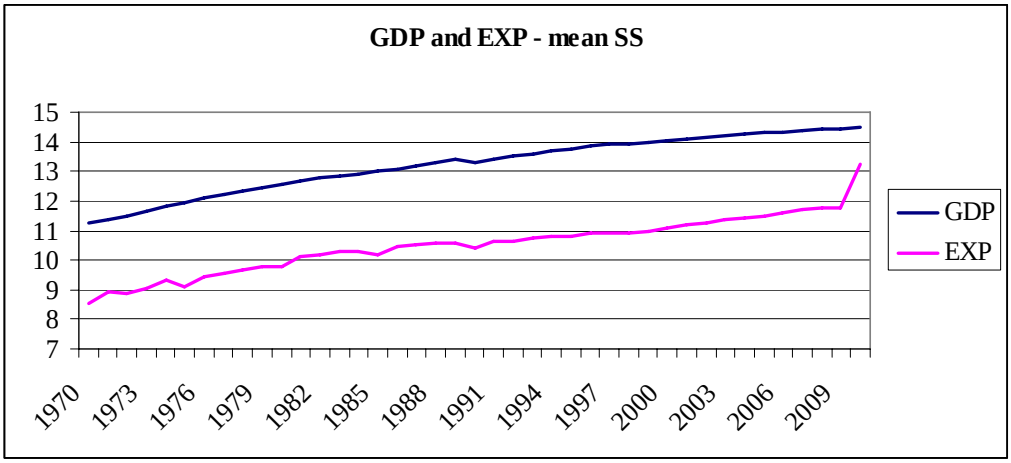


Figure A.5
RELATIONSHIP BETWEEN *GDP* AND *EXP* 1970-2010 MEAN SS



Source: Authors' elaboration base on OECD Health Data (2011).

SUMMARY. MAIN IMPLICATIONS FOR POLICY MAKING

Health care is one of the fundamental pillars of OECD countries´ welfare states. However current trends, in particular the significant increase in health expenditure produced since 1960 and the potential funding problems that could it cause, had led to questioning about the future sustainability of national health care systems. So a growing literature about health care determinants has appeared. Then, most of the reforms carried out in recent years have been aimed at controlling national health care expenditures.

In our study, we had differentiated between countries by its percentage of private health care expenditure. And we had tested is the response of health care expenditures to GDP changes differ between this two groups of countries. Our empirical results showed that those countries with where private health care expenditure outweighs over the total adjust faster than the rest of the countries considered. This result is very important in actual economic context, because policy makers, made should note than their actions are going to have effect in the long-run term. So, they should manage their options in an efficient way. That is, not cutting quickly without address on the main determinants of their national health expenditures.

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