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Abstract

The existence of relationship between economic variables has always been an object of study within the scientific community. The **aim** of this paper is to investigate the relationship between public and private (household) health expenditure (macroeconomic and microeconomic approach) over time and within recession and austerity period in Greece, in order to find out whether the strict Memorandum health policies pass, influence or go along with health expenditure to the end consumer, i.e. the health services user. In this context, **by using econometric tools** such as multiple regression and co-integration analysis on the raw micro-data of Household Budget Surveys of 1987/88 till 2018, as well as using data of public expenditure of OECD-Health Statistics 2019, in the STATA vs 13, we examined the actual impact of financial crisis in Greece. **Analysis demonstrated that** the Greek HHE was rapidly increasing during 1988-2008, when it started decreasing. The results indicate that total Private and the total Public Health expenditure seems to have a bidirectional long run relationship and significant co-integration. So, does the public expenditure with the household medical services expenditure and pharmaceuticals. Furthermore, the results indicate that over the years of recession, the monthly household health expenditure decreases, due to confiscation of middle-class income which led to consumerism restrictions. However, as households are now spending a bigger portion of their shrunken income for health (as health is an inelastic commodity), **HHE, as a proportion of total private expenditure, has eventually risen.**

Keywords: Health & healthcare spending, Greece, Household health expenditure, Recession, Austerity, Financial Crisis Impact, Economic Adjustment, Household Budget Survey (E.O.P), Multiple co-integration

JEL Classification: C32, D15, I12.

Introduction

The study of health expenditure in multiple periods of time is a difficult task which has to consider both the fact that health is a product of inelastic demand, and also that public sector has a role of "payer" and therefore the power to regulate market prices. Financial fluctuations, therefore, can affect providers, users and, ultimately, population's health.

Health sector in Greece, after a period of growth, within the first decade of the millennium when Total Expenditure on Health (% GDP, 2009) to exceed 10% (above the EU average), then it began to moderate. After signing the *Memorandum of Understanding* (M.S. / Greece: Memorandum of Understanding on specific economic policy conditionality, 2010) in 2010, a number of urgent, expenditure restricting measures and structural reforms were imposed to the Greek health sector and, in particular, to pharmaceutical sector. The last one seems to significantly contribute (negatively) to both deficit and public debt, due to excessive public spending and lack of control in both volume and cost of prescriptions.

Therefore, in May 2010, pharmaceutical industry became the focus of fiscal consolidation and was one of the main areas of intervention in order to reduce public pharmaceutical expenditure to 1% of GDP, thus approaching the European average (European Commission, 2010). As a result, public pharmaceutical expenditure decreased by 44% between 2009 and 2012, reaching 2.8 billion Euros, corresponding to 1.5% of GDP in 2012 (Foundation for Economic and Industrial Research/ IOBE, 2014).

Coupled with the economy contraction, health expenditure in Greece has been also reduced proportionally from 9.8% of GDP in 2008 to 8.1% in 2014 (Vlachadis et al., 2014). Reduced health costs, required under the austerity program, have been criticized because they do not contain specific provisions to safeguard the NHS (Vlachadis et al., 2014), a system established in the 1980s as part of the national compulsory social security program, through which most of Greek inhabitants have been cared. However, as mentioned above, Greece has failed to control health

spending between 2000 and 2009, and the health budget deficit of the country reached 50 billion Euro (Liaropoulos, 2012). Consequently, at the beginning of the crisis, the health sector was set to be a priority by the Troika, having contributed significantly to the economic derailing of the country.

This paper studies the level of public health expenditure and private Greek HHE within the period 1988-2018. Additionally, the existence of interaction between public and private expenditure was examined by using the method of co-integration, in order to determine whether a change in Greek public health spending has ultimately the same behavior with the variation of private household health expenditure. The survey results will provide an enlightening insight into the evolution of health expenditure in Greece for the past 30 years and through the evolution of the costs, the impact of the financial crisis will be determined.

Material and Methods

In the present study pre-form (raw) data derived from the Greek Statistical Authority (ELSTAT), concerning private health expenditure from the Household Budget Surveys (HBS) of year 1987, 1994, 1999, 2004, and annually from 2008 to 2018. We should bear in mind that HBS are carried out at random and at regular basis¹, by ELSTAT, throughout Greek territory. Through these surveys, information on consumer spending, income, housing facilities, consumer durables and household socio-economic characteristics and its members are collected. In regard to health expenditure, HBS records, inter alia, households' responses to pharmaceuticals expenditure-treatment-equipment devices, non-hospital medical and hospital care services, not individually, but on household level, since household in-charge-person reflects the costs and consumer behaviors of entire household. Additionally, data were drawn from the Organization for Economic Co-operation and Development (OECD- Health Statistics, 2019) on the level of public expenditure over time as a percentage of GDP. Health spending refers to the final consumption of goods and use of health services (ie current health expenditure), including personal therapeutic care

¹ every four years previously on an annual basis from 2008 onwards

(curative care, rehabilitation, long-term nursing care, ancillary health care services and medical products, prevention and public health services, as well as healthcare administrative costs, excluding investment and research- education costs).

It should be noted, here, that Health expenditures in Greece are financed through a combination of funding agencies, including public spending and mandatory health insurance (“Government / mandatory”) and private health insurance; private funds, such as out-of-pocket household payments, NGOs expenditures etc.

Data analysis was performed via STATA software, version 13, and for research purposes the technique of co-integration analysis was used.

Co-integration hypothesis

A set of time series co-integrates when there is a linear combination of these time series which are stationary; this combination cannot present a stochastic trend. The linear time series combination is the equation of co-integration that represent the long-term equilibrium relationship among these sequences. For the purposes of co-integration test, variables must be stationary at the same level. Co-integration test was performed via Johansen test (1988) in order to examine if there is co-integration between variables.

We therefore define the hypothesis:

Ho: There is no co-integration between variables.

Ha: There is co-integration

If time series are co-integrated, it means that long-term variables move together on the same direction without, however, meaning that in short-term occurs the same. The test shows if there are, and how many, linear co-integration relations between the controlled variables. The link between short-term and long-term relationship of variables is performed by the existence of co-integration, as a prerequisite for assessing the **Vector Error Correction Model**. If the findings show that in our model there is, indeed, co-integration relationship, it allows the assessment of the VEC model

(Vector Error Correction). Thence VEC model is used, because we want to simultaneously examine the results of the regressions relating to linear equations.

All assays were performed in 5% level of significance ($\alpha = 0.05$).

Results

1. Descriptive presentation of household health expenditure categories

Table 1 and Figure 1 portray the longitudinal data on the average monthly household expenditure for **Medicines, therapeutic appliances and equipment**. The results are given both for the total average cost and their subcategories. Furthermore, it should be noted that until 2008 no data were available regarding these three cost categories separately.

Table 1: Average monthly expenditure on Medicines, Therapeutic apparatus and Equipment of Greek households, during the period 1988-2018

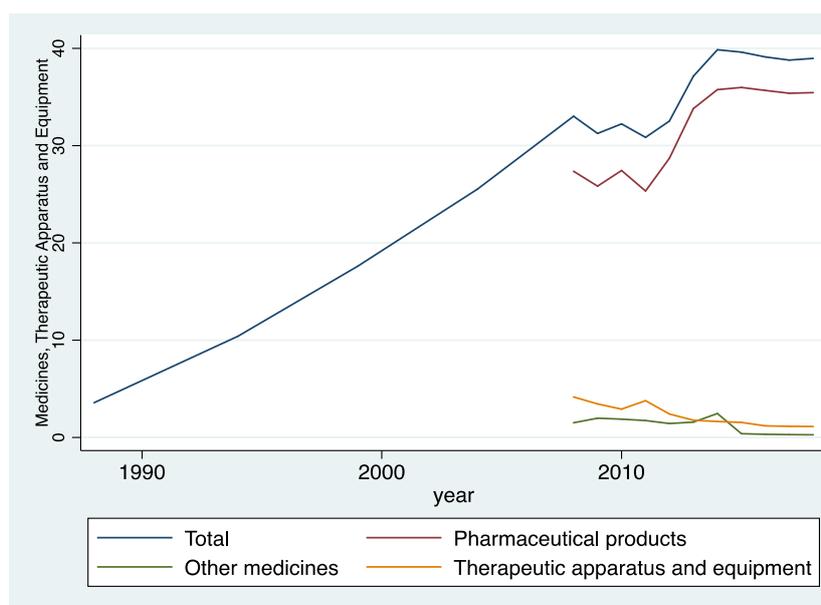
Year	Medicines, Therapeutic apparatus and Equipment	Pharmaceutical products (1)	Other medicines (2)	Therapeutic apparatus and Equipment (3)
1988	3.56	-	-	-
1994	10.4	-	-	-
1999	17.6	-	-	-
2004	25.54	-	-	-
2008	33.02	27.36	1.50	4.16
2009	31.25	25.83	1.97	3.44
2010	32.23	27.44	1.87	2.91
2011	30.84	25.33	1.73	3.77
2012	32.52	28.69	1.42	2.40
2013	37.13	33.8	1.57	1.76

2014	39.85	35.75	2.45	1.64
2015	39.60	35.98	0.38	1.54
2016	39.10	35.67	0.31	1.18
2017	38.78	35.37	0.28	1.13
2018	38.96	35.45	0.27	1.12

Source: ELSTAT (HBS raw data of 1988-2018)

Graph 2 shows that the average total household expenditure in Medicines, Therapeutic apparatus and Equipment increases rapidly from the year 1988 to the year 2018. The increase reaches 994.38%, as from EUR 3.56 in 1988 reached 38.96 EUR in 2018. Furthermore, the graph shows that within 2008-2011 (financial crisis) the average monthly household spending had a downward trend compared to previous years, while in the period 2012 to 2018 it began to rise again at considerable pace. Additionally, the results showed that the biggest proportion of the category “Medicines, Therapeutic apparatus and Equipment” expenditure comes from the medicines expenditure. In contrast, the “Other Therapeutic apparatus and Equipment” household expenditure seem to be stagnant and declining from 2004 to 2018.

Graph 2: *Evolution of expenditure on Medicines, Therapeutic apparatus and Equipment of Greek households, during the period 1988-2018, in Euro*



Source: ELSTAT (HBS raw data of 1988-2018)

In Table 2 and Graph 3 are presented the temporal data on the average monthly household expenditure on **Medical Services (Outpatient)**. The results are shown both for total average cost of medical services, and for its subcategories. Furthermore, it should be noted that there are overall figures with respect to the classification of expenditure in subcategories only after 2004.

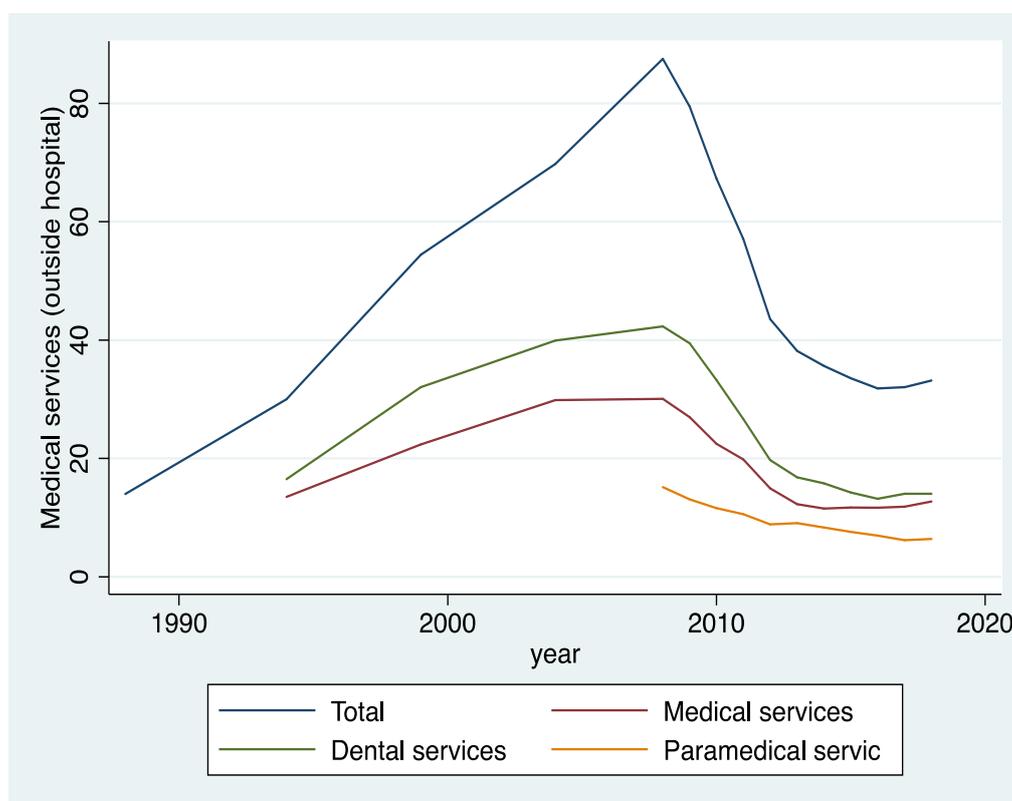
Table 2: *Average monthly expenditure on Medical Services (Outpatient) of Greek households, during the period 1988-2018, in Euro*

Year	Medical Services (Outpatient)	Medical services	Dental services	Paramedical services
1988	14	-	-	-
1994	30	13.5	16.5	-
1999	54.42	22.38	32.04	-
2004	69.76	29.85	39.91	-
2008	87.54	30.07	42.30	15.17
2009	79.48	26.96	39.45	13.07
2010	67.30	22.45	33.25	11.59
2011	57.09	19.84	26.65	10.59
2012	43.54	14.94	19.73	8.87
2013	38.15	12.27	16.81	9.08
2014	35.63	11.52	15.8	8.31
2015	33.54	11.71	14.23	7.60
2016	31.83	11.67	13.19	6.97
2017	32.03	11.83	14.02	6.19
2018	33.18	12.74	14.02	6.41

Source: ELSTAT (HBS raw data of 1988-2018)

Graph 3 shows that the average monthly total household expenditure on medical services had been increasing from 1988 to 2008 (growth rate of 525.29%, from EUR 14 in 1988 to EUR 87,54 in 2008). In contrast, within the period 2008-2018 the average monthly total household expenditure on medical services appeared to have a declining trend from EUR 87.54 in 2008, to EUR 33.18 in 2018, that is a 62.1% decrease. Additionally, the results showed that since the beginning of the financial crisis in 2008 the average household expenditure for medical services had a downward trend compared to the previous ones. Moreover, the biggest part of expenditure for medical services derives from dental services. In contrast, paramedical services expenditure seems to have been stagnant and declining from 2004 to 2018, while it happens to be the smallest percentage among three subcategories of medical expenses.

Graph 3: *Evolution of expenditure on Medical Services (Outpatient) of Greek households, during the period 1988-2018, in Euro*



Source: ELSTAT (HBS raw data of 1988-2018)

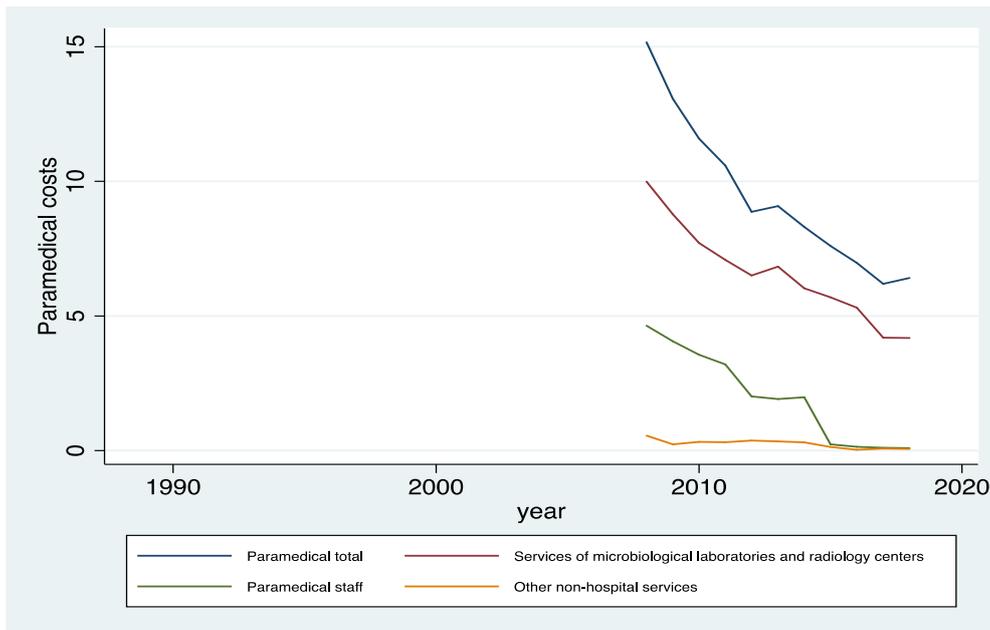
As refers to paramedical Greek household services, particularly, from HBS data of year 1987, 1994, 1999, 2004 and 2008 to 2018, it is shown that the biggest portion of expenditure for paramedical services is related to microbiological laboratory services and radiology centers, followed by paramedical staff services, while a very small percentage is attributable to other- non-hospital services. Table 14 and Graph 48 below, indicate a common and constant reduction of costs in all three subcategories over the years.

Table 3: *Average monthly expenditure on Paramedical Services of Greek households, during the period 1988-2018, in Euro*

Year	Paramedical Services	Microbiological laboratory services and radiology centers	Paramedical staff services	Other-non-hospital services
2008	15.17	9.99	4.64	0.55
2009	13.07	8.78	4.06	0.23
2010	11.59	7.71	3.56	0.32
2011	10.59	7.08	3.20	0.31
2012	8.87	6.50	2.01	0.37
2013	9.08	6.83	1.91	0.34
2014	8.31	6.03	1.98	0.3
2015	7.60	5.69	0.23	0.13
2016	6.97	5.31	0.14	0.03
2017	6.19	4.19	0.1	0.07
2018	6.41	4.18	0.09	0.06

Source: ELSTAT (HBS raw data of 1988-2018)

Graph 4: *Evolution of paramedical expenditure and subcategories of Greek households, during the period 1988-2018, in Euro*



Source: ELSTAT (HBS raw data of 1988-2018)

Next category of health expenditure relates to **Hospital Care** and analytical results are presented on Table 4 and Graph 5 below. The results show that the average monthly expenditure of Greek households for hospital care increased steadily over the period 1988-2018. Specifically, the average cost of hospitalization from EUR 3,1 in 1988 increased to EUR 35,85 in 2018, which is equal to an increase of 1056.45% (approximately tenfold average expenditure). As refers to subcategories of hospital care, it is noticed that the highest average contribution to total hospital care has the private hospital care where it is impossible to separate accommodation services and health services (medical or paramedical) followed by public hospital and private hospital care (accommodation, nutrition, etc.). From the subcategories of hospital care expenditure, the most important finding is that private hospital care expenditure where it is impossible to separate accommodation services and health services (medical or paramedical) increases considerably over the years, while other categories show either stagnation or decline.

It is also noticed that within the period 2008-2018, the average private hospital care where it is impossible to separate accommodation services and health services (medical or paramedical) expenditure increased from EUR 6.34 to EUR 24.66 (growth rate 288.96%), while the average monthly expenditure for private hospital care

(accommodation, food, etc.) decreased from EUR 6.08 to EUR 3.03 (reduction rate 50.16%) and average monthly expenditure for private hospital care (doctor's services and fees) decreased from EUR 2.91 to EUR 1.54 (reduction rate 47.08%).

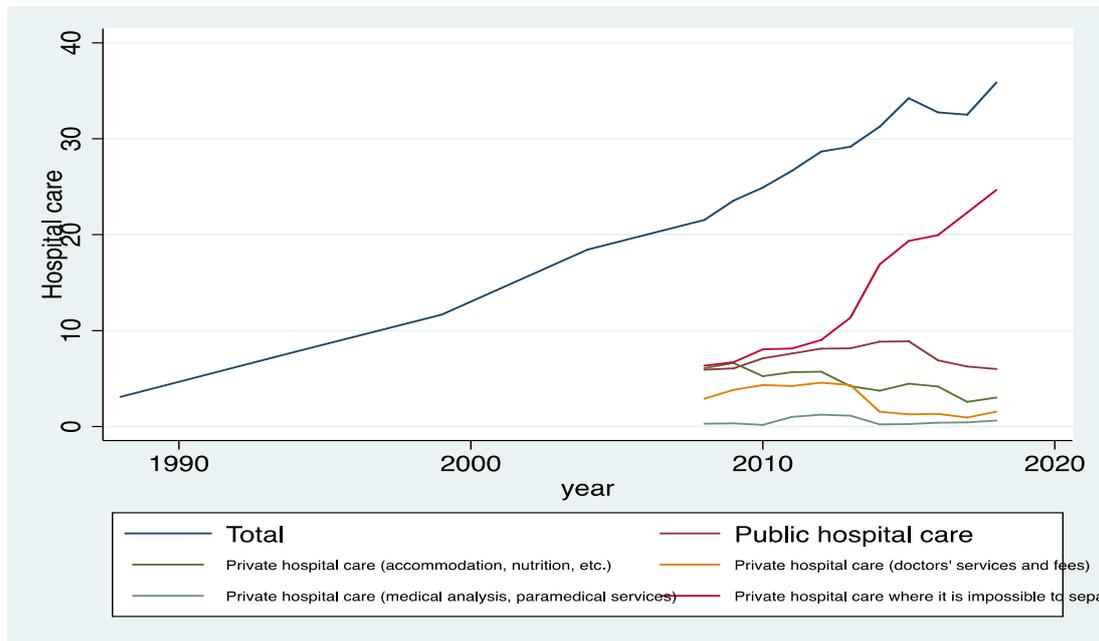
Table 4: *Average monthly expenditure on hospital care of Greek households, during the period 1988-2018, in Euro*

Year	Hospital care	Public hospital care	V1	V2	V3	V4
1988	3.1	-	-	-	-	-
1994	7.8	-	-	-	-	-
1999	11.66	-	-	-	-	-
2004	18.44	-	-	-	-	-
2008	21.54	5.93	6.08	2.91	0.29	6.34
2009	23.55	6.06	6.62	3.82	0.33	6.71
2010	24.90	7.11	5.24	4.32	0.17	8.05
2011	26.66	7.62	5.67	4.22	1.01	8.14
2012	28.66	8.12	5.71	4.57	1.24	9.02
2013	29.16	8.15	4.21	4.33	1.13	11.35
2014	31.25	8.85	3.73	1.55	0.22	16.9
2015	34.22	8.88	4.47	1.27	0.26	19.34
2016	32.75	6.90	4.18	1.32	0.40	19.95
2017	32.51	6.25	2.58	0.94	0.43	22.3
2018	35.85	6	3.03	1.54	0.62	24.66

- ❖ V1= Private hospital care (accommodation, nutrition etc),
- ❖ V2= Private hospital care (doctor's services and fees),
- ❖ V3= Private hospital care (medical analysis, paramedical services),
- ❖ V4= Private hospital where it is impossible to separate accommodation services and health care services (medical or paramedical)

Source: ELSTAT (HBS raw data of 1988-2018)

Graph 5: Evolution of hospital care expenditures of Greek households, during the period 1988-2018, in Euro



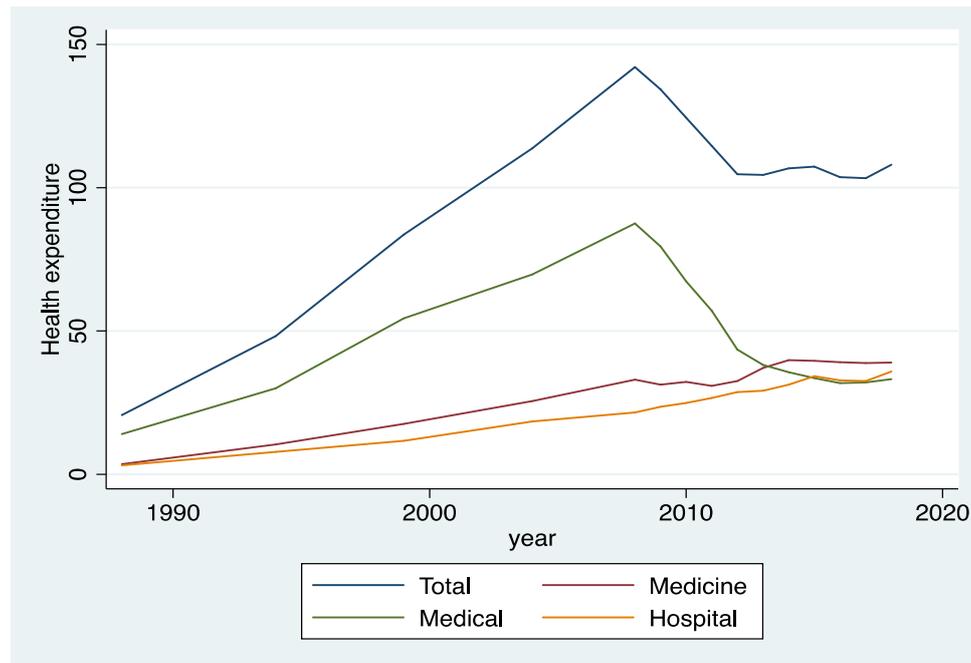
Source: ELSTAT (HBS raw data of 1988-2018)

2. Descriptive presentation of total health expenditure

Findings concerning the total HHE for the period 1988-2018 and its three main subcategories of expenditure (medical, pharmaceutical, hospital) are shown below. Graph 6 shows that **total monthly HHE in Greece had an upward trend during the period 1988-2008**. Specifically, total monthly expenditures from EUR 20,66 in 1988 reached EUR 142.1 in 2008, which refers to an increase of 587.8% (fivefold increase on expenditure). **On the contrary, from the beginning of financial crisis till 2018, the average monthly total household expenditure declined** from EUR 142.1 in 2008 to EUR 107.99 in 2018, that is a reduction of 24%. Furthermore, as follows, up to the beginning of the financial downturn in 2008, the bulk of total health expenditure derives from medical expenditure, while from 2008 onwards medical costs had a decrease of 62.1%. Then, from 2012 onwards this kind of costs equilibrated to pharmaceutical costs and expenditures for hospital care. Lastly, another important finding is that after 2008, spending on medical services seems to be largely affected,

while pharmaceutical costs and expenditures for hospital care appeared to have a small but steady increase (percentage 17.99% and 66.43% respectively).

Graph 6: Evolution of total health expenditures and its main subcategories (medical, pharmaceutical, hospital) of Greek households, during the period 1988-2018, in Euro

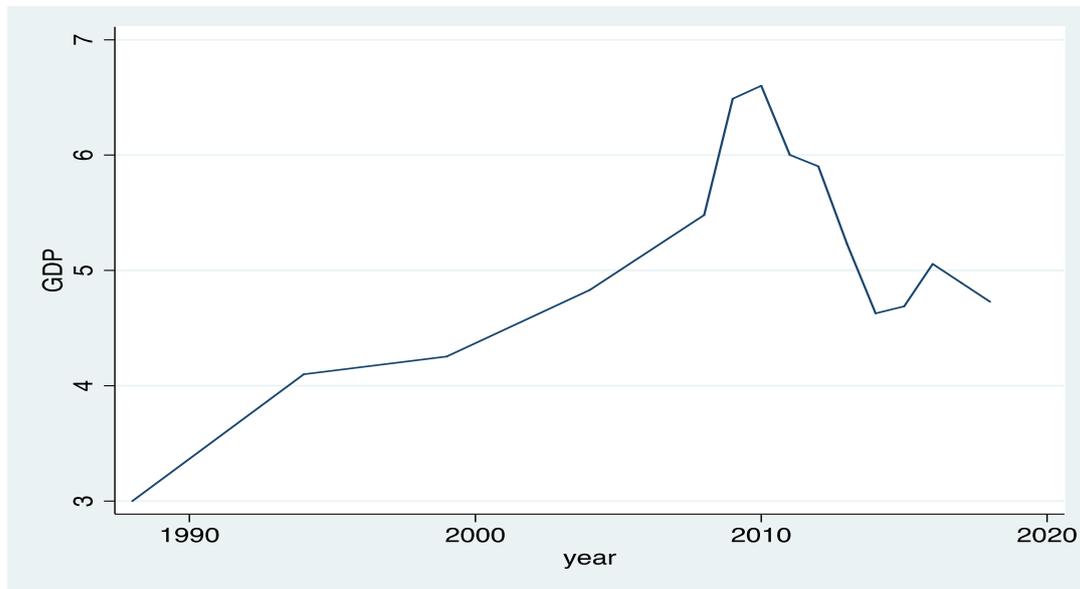


Source: ELSTAT (HBS raw data of 1988-2018)

3. Descriptive presentation of public health expenditure as percentage of GDP

Here are the findings regarding public health expenditure as a percentage of GDP of Greece. The results of the study are illustrated in Graph 7, proving that public spending had an increasing trend within the period 1988 to 2010, when the percentage of health expenditure to GDP rose from 3% to 6.6%, while from 2010 to 2018 we observed a sharp reduction in public spending due to the implementation of fiscal adjustment strict measures, from 6.6% to 4.7% of GDP.

Graph 7: *Evolution of public health expenditure as a percentage of GDP, 1988-2018, Greece*

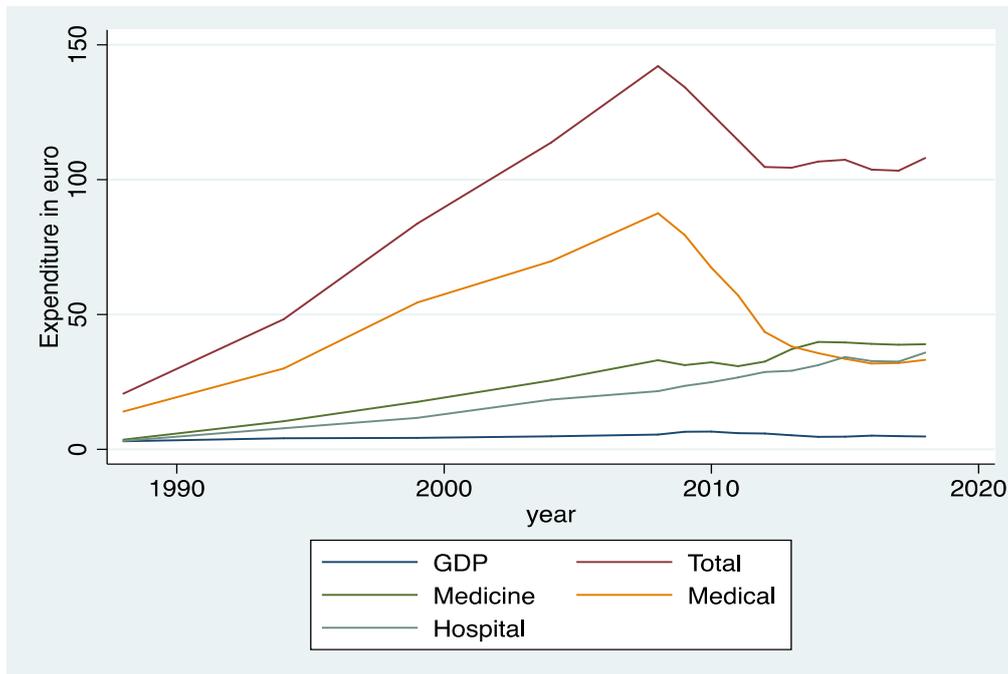


Source: ELSTAT (HBS raw data of 1988-2018)

4. Joint presentation of household health expenditure and public health expenditure development (multiple co-integration)

Graph 8 shows both, simultaneously, HHE and public health expenditure development. According to it, private household expenditure seems to go hand in hand with public expenditure, since, as mentioned above, total household spending appears to have a strong growth during the period 1988-2008 and a significant reduction during the period 2008-2018. Total public expenditure shows, also, strong growth during the period 1988-2010 and significant reduction in the period 2010-2018.

Graph 8: *Evolution of public health expenditure as a percentage of GDP and Greek household health expenditure, 1988-2018*



Source: OECD Health Statistics, 2019 & ELSTAT (HBS raw data of 1988-2018)

5. Co-integration analysis results between public health spending and Greek household health expenditure

In the last section of results are presented data regarding integration of HHE to public expenditure as a percentage of GDP. Due to few observations (which does not allow us to draw reliable conclusions), Johansen test does not yield results in the total data set and therefore, it was chosen to apply integration test between public health expenditure and total private health expenditure (Table 5) and between public health expenditure and the two main categories of private health expenses (medical and pharmaceutical).

Table 5 shows that for $r = 0$, the null hypothesis is rejected (since trace statistic > critical value) and this means that we reject the hypothesis of co-integration equation absence. Conversely, for $r = 1$, the null hypothesis is not rejected ($2.16 < \text{critical value} = 3.74$) and we do not reject the null hypothesis that there is only one co-integration equation.

This means that **there is a co-integration relationship between public health spending and private health expenditure.**

Table 5: *Co-integration analysis results between public health spending and Greek household health expenditure*

Johansen tests for cointegration						
Trend: trend			Number of obs =		9	
Sample: 2010 - 2018			Lags =		2	
maximum				trace	5%	
rank	parms	LL	eigenvalue	statistic	critical	value
0	8	-19.389823	.	26.6515	18.17	
1	11	-7.1448956	0.93420	2.1616*	3.74	
2	12	-6.0640754	0.21352			

Source: OECD Health Statistics, 2019 & ELSTAT (HBS raw data of 1988-2018)

Subsequently, co-integration equation was evaluated and the multivariate model/error correction model VEC (Vector Error Correction Model or otherwise ECVAR) and the results are detailed in Table 6 below.

The **co-integration equation** is:

$$ECT_{t-1} = 4.635 + Household\ HE_{t-1} - 22.832 \cdot Public\ HE_{t-1}$$

VEC indicates that long-run equilibrium equations are:

$$\begin{aligned} \Delta(Public\ HE)_t &= -0.718 \cdot ECT_{t-1} + 1.826 \cdot Public\ HE_{t-1} + 2.218 \\ &\quad \cdot Household\ HE_{t-1} - 0.0002 \end{aligned}$$

$$\begin{aligned} \Delta(Household\ HE)_t &= 0.681 \cdot ECT_{t-1} - 0.681 \cdot Public\ HE_{t-1} - 0.104 \\ &\quad \cdot Household\ HE_{t-1} - 0.002 \end{aligned}$$

Table 6: *Co-integration equation and VEC model results between Greek public expenditure and household health expenditure*

Johansen normalization restriction imposed						
beta	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
_ce1						
V1	1	.	.	.	.	.
GDP	-22.83186	1.574286	-14.50	0.000	-25.9174	-19.74632
_cons	4.635125	.	.	.	.	.
D_V1						
_ce1						
L1.	-.7181892	.290038	-2.48	0.013	-1.286653	-.1497253
V1						
LD.	2.218084	.6594626	3.36	0.001	.925561	3.510607
GDP						
LD.	1.826119	2.789096	0.65	0.513	-3.640409	7.292648
_cons	-.0001754	1.575419	-0.00	1.000	-3.08794	3.087589
D_GDP						
_ce1						
L1.	.0680826	.0089817	7.58	0.000	.0504788	.0856865
V1						
LD.	-.1026407	.0204218	-5.03	0.000	-.1426667	-.0626147
GDP						
LD.	-.0681388	.086371	-0.79	0.430	-.2374228	.1011451
_cons	-.0018506	.0487866	-0.04	0.970	-.0974705	.0937694

Source: ELSTAT (HBS raw data of 1988-2018)

The above-mentioned results suggest that there is **statistically significant co-integration between public expenditure and private household spending**. Public expenditure (GDP) coefficient in the co-integration equation is statistically significant, so are the adjustment parameters. The adjustment parameters in this bilateral example are easy to be interpreted and one can notice that the estimates have the correct signs (negative) and indicate rapid adjustment toward equilibrium, showing that as public health expenditures increase, private expenditures are reduced

(negative: $b = -22.832$, $p < 0.05$). Estimation of coefficient D_V1 ($ce1$) equals to -0.718 ($p < 0.05$). Therefore, when the average rate of private expenditure is very high, it quickly falls to the level of public expenditure. The estimated coefficient D_GDP ($ce1$) equals to 0.068 ($p < 0.05$) and indicates that the average rate of public spending is quickly adapted to the levels of private spending. This means that approximately 71.8% of the imbalances between private and public expenditure is corrected by changes in private spending, while only 6.8% of the imbalances is corrected by changes in public spending.

Results clearly indicate a bi-long relationship between private and public expenditure, where private spending seems to be adapted more rapidly to public spending, while are those who, mainly, correct the imbalance between private and public expenditure.

Discussion

Greek healthcare system faces public funding gap, as a result of the current financial crisis and relevant austerity measures being forced. Official data have shown that Greece's GDP has been contracted by 25%² within the last decade, and this has had an impact on health expenditure of Greek households (of already high O.P.P.), as well. Based on literature review, it is clear that most OECD countries followed, more or less, the same route: increase in spending during pro crisis period and declining afterwards. The austerity program, in which Greece entered due to financial crisis, has, indeed, significantly affected HHE, as well.

Limitations

Perhaps the most important limitation of any study concerning private health expenditure is the lack of data on informal payments (under the table payments to medical staff, etc.) which constitute the phenomenon of shadow economy and make the already enormous private health costs in even higher levels. Although part of these informal payments is included in HBS, making them more reliable than other surveys,

² from 242 billion euro in 2008, to 184,70 billion euro in 2018 (ELSTAT, 9/2019)

in no way they are considered to be representative of the actual size. In addition, presented data in this study may not fully reflect Greek health expenditure, given the relatively short period of studying. Further research and comparative analysis are needed, to identify the impact of Greece's financial crisis on HHE, whereas the effect of economic crisis appears clearer over the longer periods of time.

Conclusions

The austerity program, in which Greece entered due to financial crisis, significantly affected health expenditure. The results of this study showed that **the average total household expenditure increased fivefold from 1988 to 2008 and from 2008 to 2018 the average total expenditure of households on health decreased by 24%.**

Regarding subsets, it was shown that the average household expenditure on medicines, therapeutic appliances and equipment were considerably increased from 1988 to 2018, while it seemed that it was the only category which was not affected significantly by the financial crisis. Similarly, average household spending on hospital care increased notably from 1988 to 2018 and was affected very slightly by economic crisis. Conversely, average costs for medical services showed an upward trend from 1988 to 2008 and then, a significant decrease from 2008 to 2018.

As refers to public expenditure, the results showed that there was an increase during the period 1988-2010 and decrease during the period 2010 to 2018. In fact, one can say that **households at the onset of the financial crisis have had reduced health expenditure, while the state has been adapted to this situation two years later.**

Lastly, the co-integration analysis showed **significant co-integration** between **public health expenditure to total household expenditure** and significant cointegration between **public health expenditure and medical and pharmaceutical household expenditure.**

On the basis that Health Expenditure will sparingly begin to rise, in the foreseeable future, **it is recommended that** Health Policy planning should consider the severe

impact of population ageing, with simultaneous smaller share of active population, which means significant revenue shortfalls and healthcare funding difficulties.