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The impact of the Greek economic adjustment programme on household health expenditure

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ABSTRACT

In late 2009, Greece faced an unprecedented sovereign debt crisis and shortly after signed a large-scale economic adjustment program (EAP) that brought about several changes and reforms to the Greek health care system. As a result, households experienced the "triple hit" of decreased availability and capacity of the public health system, increased user charges, and lower ability to pay for health care. This study examines how households behaved in the face of such an economic shock and the aforementioned "triple hit". It also focuses on how household payments for health care responded to income changes before and after the introduction of the EAP. By using data from the Greek Household Budget Surveys over 2008–2015, we employ a modified two-part model to identify the determinants of household health expenditure (HHE) and estimate the corresponding income elasticities before and after the introduction of the EAP. We find that the income elasticity of HHE is consistently below unity and exhibits a statistically significant increase after the introduction of the EAP. Thus, households appear to exhibit greater consumption responses to changes in their income during the post-EAP period. In addition, we report heterogeneity in income elasticity across household types and over the HHE distribution. Lastly, our analysis suggests that the magnitude of income elasticity is sensitive to the household welfare indicator used. In other words, we show that HHE responses to permanent income changes are greater than the ones arising from current income shocks. Our findings can inform policymakers about household health care behavior and provide useful evidence for health financing and the design of social safety nets.

1. Introduction

After notable growth in the 2000s, the Greek economy faced an unprecedented sovereign debt crisis in late 2009. In particular, the budget deficit for 2009 was significantly larger than that initially stated (approximately 15% of GDP), and this adverse announcement along with the country's high debt-to-GDP ratio and moderate growth prospects triggered concerns about the solvency of the Greek economy, with several agencies subsequently downgrading Greece's credit rating (Ardagna and Caselli, 2012). In this context, Greece was at the epicenter of an economic crisis that tested the limits and threatened the stability of the Eurozone (De Grauwe, 2010). The government at the time eventually requested a bailout package and pledged to implement a large-scale economic adjustment program (EAP) in early 2010 with the technical assistance of the European Commission, International Monetary Fund, and European Central Bank. To address the chronic weaknesses of the Greek economy, this EAP imposed strict fiscal consolidation, external rebalancing, and large-scale structural reforms across sectors (Thomadakis, 2015). During 2008–2015, GDP shrank by more than 25%, the unemployment rate increased from 7.8% to 24.9%, and residential property values decreased by more than a third (Meghir et al., 2017). At the same time, the fragmented social protection system failed to absorb the consequences of the deep crisis, and social indicators and living conditions dramatically deteriorated (Matsaganis, 2012; OECD, 2014). The share of the population severely materially deprived escalated from 11.2% to 22.2% during 2008–2015, while the share of the population having unmet medical needs for financial reasons increased from 4.2% to 10.9% over the same period.

The Greek crisis has several distinctive features. First, it is characterized by an unprecedented length and intensity, even compared with the Great Depression in the United States. Indeed, it was the deepest and most severe economic downturn across OECD countries in the postwar period (Andriopoulou et al., 2017) and among the worst in modern history. Second, the EAP required an extreme fiscal adjustment to move towards a primary budget surplus. This adjustment has been characterized "*as everything but painless*" (Meghir et al., 2017). Third, although several countries have managed to gradually overcome the post-2009 economic crisis, the Greek economy is still struggling to

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successfully disengage from the EAP.

Being a crucial field for public policy, health care was among the top priorities in the agenda of the EAP, not only from a fiscal savings perspective, but also in terms of promoting structural reforms within the health system (OECD, 2014). In this context, the EAP included two major measures directly related to health financing. First, it imposed significant cuts in health expenditure as a fiscal consolidation measure. In particular, public health spending was capped at 6% of GDP. In other words, the public sector was forced to address increasing health needs with reduced financial resources, possibly leading supply to be inadequate to respond to households' health care needs (Mladovsky et al., 2012). Second, user charges increased during the post-EAP period, especially for pharmaceuticals (Economou et al., 2014). Hence, households experienced a "double hit" of the decreased availability and capacity of the public health system and higher user charges. In addition, a third hardship for Greek households was associated with the reduced disposable income (due to salary cuts and tax increases) and increase in unemployment, which in turn resulted in lower household purchasing power and ability to pay for health care. In broader terms, an economic crisis is generally associated with insecurity about the future, as households worry about the growing debt and loss of wealth, and thus change their perceptions of their employment and income prospects (Petev and Pistaferri, 2012).

Taking the aforementioned into account, a crucial, but rather understudied, question relates to how households' health care consumption changes in the face of an economic shock and the aforementioned "triple hit" (i.e., cuts in public health expenditure, increase in user charges, decrease in disposable income). Although several studies have examined household behavior towards the consumption of health care and the responsiveness of household health expenditure (HHE) to income changes (Chaze, 2005; Getzen, 2000; Zare et al., 2013; Zhou et al., 2011), there is scant evidence on how HHE responds to income changes before and after large-scale economic adjustment and shocks. To our knowledge, the only two relevant studies of this topic focus on countries hit by the 1997 East Asian crisis. By using household data from Thailand, Okunade et al. (2010) found that household consumption of health care became more responsive to income changes (i.e., higher income elasticity) after the onset of the 1997 crisis. Yang et al. (2001) reported similar findings for Korea, although their methodology was based on aggregate data and a two-point estimate of income elasticity.

2. Hypothesis development

In periods of economic downturn, households often reduce HHE and shift towards public services because of their lower ability to pay out-of-pocket expenditure (OOPE) (Waters et al., 2003; Yang et al., 2001). In Greece, this is depicted by the significant increase in hospital admissions, outpatient visits, and laboratory tests in public health services after the introduction of the EAP (Institute of Social and Preventive Medicine, 2016; Kentikelenis and Papanicolas, 2012). Moreover, households may decide to reduce non-essential health care expenses in response to economic distress (Yang et al., 2001) and private health care payments might become less "necessary" given the alternative of using public services in a period of severe financial hardship. On that basis, we formulate the first hypothesis:

Hypothesis 1. HHE became more sensitive to income changes (income elastic) in the post-EAP period.

The composition of HHE may differ across households of different socioeconomic status (SES). For instance, the HHE of less privileged households primarily comprises OOPE for pharmaceuticals, while they tend to incur lower expenses at hospitals, as outpatients, and for dental care. In this context, a different mix of health care goods and services might result in heterogeneous consumption changes in response to altering income since expenses for some types of health care (e.g., cost-sharing for medicines) are more essential and cannot be easily avoided or postponed. Hence, the second hypothesis is as follows:

Hypothesis 2. Health care consumption responses to income changes (different income elasticities) differ across household types.

As mentioned above, households have the option to shift to public services and avoid OOPE for some types of health care. Moreover, they may reduce OOPE for non-essential goods and services because of financial constraints. However, there is no substitute for user charges, which constitute a prerequisite for gaining access to some types of health care. For instance, cost-sharing schemes in pharmaceutical care imply that individuals should pay user charges to receive and adhere to their therapy. In this context, one could expect that those households whose HHE primarily consists of payments for user charges would not become more sensitive to income changes after the introduction of the EAP because their HHE is relatively rigid, consists of payments for essential goods and services, and cannot be substituted by shifting towards public services. We thus develop the following hypothesis:

Hypothesis 3. Contrary to privileged households, vulnerable households did not become more sensitive to income changes in the post-EAP period.

Our last hypothesis largely relies on the so-called permanent income hypothesis. In particular, several formal and informal mechanisms for borrowing, saving, and selling assets allow households to smooth their consumption over time (Damme et al., 2004). In this context, consumption responses to current income changes may be more modest, since one could expect that consumers will alter their behavior and respond strongly to more permanent income changes (Hall and Mishkin, 1982). We thus test such a hypothesis for the case of HHE:

Hypothesis 4. HHE responses to permanent income changes are greater than those arising from current income changes (i.e., permanent income elasticity is higher than current income elasticity).

3. The Greek case

Examining HHE in the Greek health care system is particularly interesting for two reasons. First, traditionally, health financing in Greece has been largely funded by HHE (Thomson et al., 2009). This historical pattern is particularly evident when examining OOPE from a comparative perspective, as shown in Figure A1 (in the Online Supplementary File). In particular, Greece's OOPE (as a percentage of health expenditure) is substantially higher than that in other EU and OECD countries. Indeed, OOPE in Greece accounts for 35% of total health expenditure, whereas the EU average is only 15% (OECD/EU, 2016).

In general, the high OOPE in Greece can be attributed to the deficiencies of the public health system, including waiting lists and financial barriers to access, low satisfaction and responsiveness, and low quality of care (Mossialos et al., 2005). The main health policy concern arises from the fact that this historical pattern clearly attenuates the extent to which equity in financing can be achieved in the Greek health system, while low-income groups disproportionately contribute to financing health care (Economou, 2010). Additionally, Greece has the lowest percentage of the population covered by health insurance (public and/or private) among OECD countries, a fact that also exacerbates the problem and increases reliance on OOPE (OECD, 2017).

In addition to health financing in Greece being highly dependent on OOPE, a second aspect makes the Greek case particularly interesting. As noted above, Greece signed a bailout agreement and implemented a large-scale EAP amid a severe sovereign debt crisis, leading to a "triple hit" with profound implications on health financing. Hence, both the level and the composition of average HHE from 2008 to 2015 differ substantially, which motivates further empirical research on HHE in the Greek context (see Figure A2 in the Online Supplementary File).

Therefore, analyzing the relationship between income and HHE for

the Greek case is particularly interesting because of (a) the high HHE and (b) the change in the level and composition of HHE associated with the impact of the EAP both on demand for and on the supply of health care.

4. Data and methods

4.1. Data

We analyze a pooled dataset drawn from the cross-sectional Household Budget Survey (HBS), a nationally representative household survey conducted annually by the Hellenic Statistical Authority from 2008 to 2015. These surveys include variables about demographics, household size and composition, employment, education, income, insurance characteristics, nationality, and region and provide detailed information on household expenditure. The dataset we used consists of 33,089 observations.

4.1.1. Dependent variable

The main dependent variable of this study is HHE. By using the corresponding CPI, expenditure is deflated and converted into 2015 prices to reflect real values.

4.1.2. Independent variables

The main variable of interest is net household income, deflated and adjusted to 2015 prices. We also use a dummy for the EAP, which takes the value of 1 for the years after the introduction of the EAP (2010–2015). Moreover, our model includes an interaction term between the EAP dummy and net income, which aims to capture whether the introduction of the EAP modifies the association between income and HHE.

We also control for three main sets of variables widely employed in the literature for household consumption behavior. The first set of regressors includes several characteristics of the household head: sex, age, educational attainment, marital status, employment, and insurance status. Second, in terms of household characteristics, we control for (a) household size, (b) squared household size, (c) the number of household members aged less than 4, and (d) the number of elderly (aged more than 65 years old). We focus on these age groups because they are generally considered to have a greater need for and utilization of health care. In addition, our model includes region fixed effects to control for regional variation. A detailed description of the variable is presented in Table A1 in the Online Supplementary File.

Apart from income, we extend the analysis by using an alternative proxy for the household's financial situation (i.e., consumption). Household spending decisions are often based on long-run resources rather than current income. For instance, households may decide to relax their budget constraints either by liquidating assets or by bearing additional debt to afford the burden of OOPE for health care. However, given that HHE and total expenditure are simultaneously determined, we use non-health expenditure as an independent variable, excluding health care spending-related goods and services (Lépine, 2015).

Additionally, based on previous studies of income inequality and poverty (Abul Naga and Burgess, 1997; Abul Naga, 1994), we use the available welfare indicators in the HBS (i.e., disposable income and consumption expenditure) to construct a composite welfare indicator (CWI) that captures the concept of permanent income. Previous work based on data from the Greek HBS has created a similar CWI (Mitrakos and Tsakloglou, 1998, 2010). The Online Supplementary File presents additional methodological details for the construction of the CWI.

4.2. Empirical models

4.2.1. Two-part model

Our main empirical model is a modified two-part model (MTPM) (Mullahy, 1998). In particular, the first part identifies whether health expenditure is positive; this is a binary response model in which the dependent variable takes the value of 1 if health expenditure is positive. Conditional on a positive value, the second part focuses on the level of HHE. Based on these remarks, our main model consists of (a) a logit for the whole sample and (b) a generalized linear model (GLM) with a log-link function (i.e., exponential conditional mean model) and a gamma error distribution for the set of positive outcomes.

In particular, the first part of the model is a logit given by the following expression:

$$\Pr(Y > 0 \mid x) = \frac{\exp(xa)}{1 + \exp(xa)} \tag{1}$$

where x is the vector of the independent variables and a is the vector of the regression coefficients.

The second part of the MTPM is a GLM with log-link and gamma family distribution. In this context, the second part can be presented by the following equation:

$$E(y \mid y > 0,\ x) = \exp(x\beta) \tag{2}$$

where β is the vector of the regression coefficients for the second part of the model. Based on (1) and (2), the MTPM can be written as

$$E(Y \mid x) = \Pr(Y > 0 \mid x) \times E(y \mid y > 0,\ x) = \frac{\exp(x\alpha) \times \exp(x\beta)}{1 + \exp(x\alpha)} = \frac{\exp(x(a + \beta)}{1 + \exp(x\alpha)} \tag{3}$$

The choice of this model is based on several specification tests. In particular, we employ a modified Park test to identify the distribution family (i.e. the relationship between the mean and the variance). In addition, we rely on several tests (Pregibon link test, Pearson correlation test, modified Hosmer and Lemshow test) to determine the GLM link function (i.e. the relationship between the linear predictor and the mean) (Deb and Norton, 2018; Manning et al., 2005). Last, we present some measures for goodness of fit and model performance (i.e. mean squared error, root mean squared error, mean absolute prediction error) (Jones, 2010). More details are presented in the Online Supplementary File (Tables A3 and A4).

In addition to the baseline model, we also estimate alternative models for robustness checks. First, we employ a TPM with a logistic regression as a first part, and a linear regression model with a log-transformed dependent variable in the second part. For this model, we also use the Duan smearing method of retransformation (Duan, 1983). Second, we carry out a similar analysis using a MTPM, in which the second part has a log link function and a Poisson family distribution.

4.2.2. Single-equation modeling

Apart from the TPM, we employ single-equation models for the total sample that have been also used in the existing literature for modeling health expenditure (Buntin and Zaslavsky, 2004; Mihaylova et al., 2011). In particular, we focus on (a) linear regression model with log-transformed dependent variable, estimated by OLS, (b) GLM with log link and Gamma family distribution, and (c) GLM with log link and Poisson family distribution.

4.2.3. Quantile regression models

Empirical techniques such as OLS and GLM model the dependent variable by using a conditional mean function. However, the income elasticity of HHE may vary depending on the level of HHE. We thus undertake an additional analysis to describe the relationship between HHE and the independent variables at different points of the conditional HHE distribution. To do so, we employ quantile regression models. In particular, such a technique allows us to identify the potential variation in the income elasticity of HHE at different points of the conditional distribution of the response variable.

4.2.4. Instrumental variable approach

Most estimates of income elasticity of HHE generally tend to ignore potential endogeneity concerns (Trivedi, 2002; Zare et al., 2013). As an additional robustness check, we relax this assumption, and employ an instrumental variable (IV) approach aiming to address potential endogeneity issues, such as measurement error in income. In particular, the presence of measurement error might induce bias in our estimates, and we thus check their robustness after obtaining exogenous variation in income. In this context, an IV should be correlated with income, and should not be correlated with the error term (Hausman, 2001).

We instrument income with a household-specific asset/wealth index to address potential endogeneity issues. This index was constructed using a principal component analysis, and further details are presented in the Online Supplementary Material. As a robustness check, we employed an IV model using the sum of the household assets as an IV for income.

Several studies that examine household demand have used ownership of assets or an asset/wealth index as instrument for household income (Ali et al., 2018; Lépine, 2015; Lindelow, 2005; Rous and Hotchkiss, 2003; Skoufias et al., 2009; Skoufias et al., 2012). Indeed, a large body of the literature suggests that such an index and its components (e.g. ownership of assets, housing characteristics) are generally correlated with household income (Jofre-Bonet et al., 2018; Skoufias et al., 2012; Strauss et al., 2004), and our instrument thus satisfies the relevance condition. In addition, households are generally expected to make negligible errors when reporting this type of information especially compared to reporting their income (Filmer and Scott, 2012; Glewwe and Nguyen, 2002; Wittenberg and Leibbrandt, 2017).

Given that the first-stage F statistic exceeds the minimum threshold of 10, empirical evidence supports the strength of our instruments. Therefore there is no weak identification problem (Staiger and Stock, 1997). Additionally, we obtain the Kleibergen-Paap rk LM statistic and the Cragg-Donald Wald F-statistic to test for under-identification and weak identification respectively. These tests provide evidence in favour of the choice of our instrument, since they suggest that our models do not suffer from under-identification or weak identification.

5. Results

5.1. Summary statistics

HHE decreased after the introduction of the EAP, and Fig. 1 illustrates that there is a shift of the Kernel density function to smaller values.

Approximately 13.2% of the observations report zero HHE, while the percentage of the sample with zero expenditure is much higher for the other types of expenditure (more details are presented in the Online Supplementary File Table A2). The high frequency of zeros is essentially the main reason we opt for a TPM as our main empirical specification. There are substantial differences in the means of net household income, age, household head education, and employment as well as in household size and the composition between households with zero and non-zero HHE.

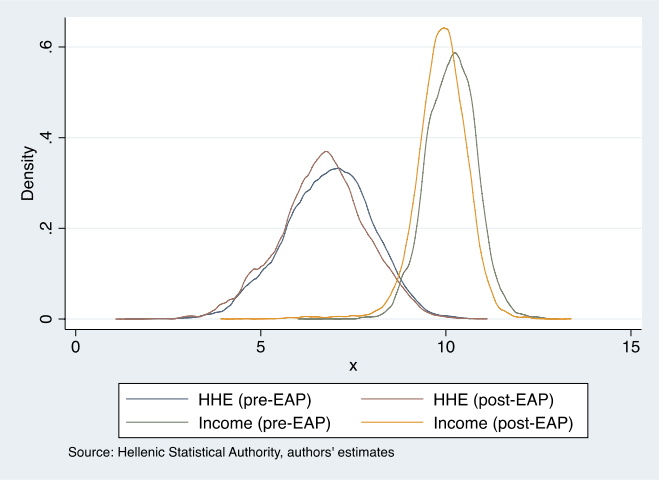

Fig. 1. Kernel density estimate of household health expenditure and income.

5.2. Regression analysis

5.2.1. Probability of health care spending

According to Table 1, income is positively associated with the probability of HHE, while the coefficient of the variable for the EAP is negative, suggesting that the period after the introduction of the EAP is associated with a lower probability of spending. Given that the coefficient of the interaction term is positive and statistically significant, our analysis demonstrates that the relationship between income and the probability of having non-zero HHE changes with the introduction of the EAP. These findings remain robust across different model specifications and after using IV techniques to address potential endogeneity issues.

We find a strong association between the household head's demographics and probability of health care spending. The odds of health care spending by households with older household heads are higher (and increasing with age) relative to the odds of spending for the age group of 15–34. For instance, the odds of health care spending by a household whose head is more than 75 years old are more than twice the odds for a household with a young head. Similarly, the odds of having non-zero HHE for a household with a male head are approximately 0.71 times the odds for one with a female head. Contrary to educational level, urbanity, household size and composition, and household heads' marital, employment, and insurance statuses are all statistically significant determinants of the probability of incurring OOPE. For instance, household size, the number of household members aged under 4, and the number of household members aged over 65 years old are all positively associated with the probability of having non-zero health spending.

Based on the first part of the MTPM, Fig. 2 presents the predicted probability of non-zero HHE for different income levels, which is increasing with income for both periods. Moreover, in the post-EAP period, the predicted probability of non-zero HHE is lower than that in the pre-EAP period, especially for low-income households.

5.2.2. Level of HHE

Column 2 in Table 1 shows the baseline estimates of the second part of the MTPM, which models health expenditure conditional on its positive value. The dummy indicating the EAP has a negative coefficient (and is statistically significant at the 1% level), suggesting that the post-EAP period is also negatively associated with HHE. Income is positively associated not only with the probability of health care spending (as suggested in the first part), but also with the level of expenditure. The significance and sign of the interaction term indicate that the introduction of the EAP modifies the association between income and HHE. These findings also remain robust to alternative specifications in the second part of the TPM, as shown in Columns 4 and 6 in Table 1. Estimates from single-equation models, reported in the Online Supplementary File Table A5, further validate our results. Last –using an asset index as instrument for income- Table 1 (column 8) shows the estimates of a 2SLS model, and indeed confirms that our findings are strong and robust after using an IV approach.

Apart from income, other socioeconomic characteristics such as education, employment, and marital status also appear to be statistically significant determinants of HHE. On the contrary, although a household head's core demographics (sex, age) are statistically significant predictors of the probability of incurring non-zero HHE, they are not significantly associated with the level of HHE conditional on its

Table 1
Two-part model, total sample (2008–2015 household data).

	MTPM (logit, Gamma)		TPM (logit, log-transformed OLS)		MTPM (logit, Poisson)		IV probit	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Participation equation	Expenditure equation	Participation equation	Expenditure equation	Participation equation	Expenditure equation	Participation equation	Expenditure equation
EAP	−2.113***	−0.901***	−2.113***	−0.901***	−2.113***	−1.836***	−1.974***	−0.961**
	(0.774)	(0.324)	(0.774)	(0.289)	(0.774)	(0.418)	(0.615)	(0.384)
Log income	0.402***	0.421***	0.402***	0.405***	0.402***	0.447***	0.487***	0.707***
	(0.073)	(0.030)	(0.073)	(0.026)	(0.073)	(0.035)	(0.067)	(0.044)
EAP x Log income	0.151**	0.079**	0.151**	0.075***	0.151**	0.172***	0.177***	0.089**
	(0.077)	(0.032)	(0.077)	(0.029)	(0.077)	(0.041)	(0.061)	(0.038)
Male	−0.342***	−0.018	−0.342***	−0.060**	−0.342***	−0.022	−0.215***	−0.086***
	(0.064)	(0.031)	(0.064)	(0.027)	(0.064)	(0.033)	(0.028)	(0.022)
35-44	0.165**	−0.020	0.165**	−0.017	0.165**	−0.045	0.082**	−0.057*
	(0.076)	(0.047)	(0.076)	(0.040)	(0.076)	(0.051)	(0.039)	(0.035)
45-54	0.116	−0.036	0.116	0.014	0.116	−0.088*	0.024	−0.036
	(0.079)	(0.047)	(0.079)	(0.042)	(0.079)	(0.052)	(0.041)	(0.037)
55-64	0.339***	0.081	0.339***	0.124***	0.339***	0.052	0.108**	0.059
	(0.088)	(0.050)	(0.088)	(0.044)	(0.088)	(0.055)	(0.046)	(0.040)
65-74	0.538***	0.004	0.538***	0.081	0.538***	0.028	0.235***	0.017
	(0.134)	(0.062)	(0.134)	(0.052)	(0.134)	(0.072)	(0.061)	(0.047)
75+	0.996***	0.034	0.996***	0.194***	0.996***	0.061	0.471***	0.171***
	(0.150)	(0.066)	(0.150)	(0.055)	(0.150)	(0.073)	(0.066)	(0.048)
Primary/lower secondary education	−0.129	−0.044	−0.129	−0.079***	−0.129	−0.059*	−0.120***	−0.079***
	(0.082)	(0.027)	(0.082)	(0.024)	(0.082)	(0.030)	(0.035)	(0.021)
Upper and post-secondary education	−0.111	0.078**	−0.111	0.017	−0.111	0.066*	−0.202***	−0.077***
	(0.090)	(0.034)	(0.090)	(0.029)	(0.090)	(0.038)	(0.041)	(0.027)
Higher education	0.072	0.145***	0.072	0.107***	0.072	0.095**	−0.224***	−0.080**
	(0.101)	(0.039)	(0.101)	(0.034)	(0.101)	(0.044)	(0.052)	(0.036)
Intermediate population density	0.031	−0.020	0.031	−0.006	0.031	−0.028	0.052**	0.008
	(0.058)	(0.027)	(0.058)	(0.023)	(0.058)	(0.030)	(0.026)	(0.019)
Sparsely populated	−0.125**	0.034	−0.125**	0.030	−0.125**	0.024	−0.023	0.068***
	(0.062)	(0.025)	(0.062)	(0.022)	(0.062)	(0.028)	(0.027)	(0.019)
Household size	0.201***	0.051	0.201***	0.048	0.201***	0.042	0.002	−0.056*
	(0.069)	(0.034)	(0.069)	(0.032)	(0.069)	(0.037)	(0.040)	(0.029)
Household size squared	−0.030***	−0.006	−0.030***	−0.004	−0.030***	−0.006	−0.006	0.003
	(0.010)	(0.004)	(0.010)	(0.005)	(0.010)	(0.005)	(0.005)	(0.004)
Divorced	−0.194*	−0.027	−0.194*	−0.073	−0.194*	0.008	−0.068	−0.069*
	(0.102)	(0.052)	(0.102)	(0.046)	(0.102)	(0.057)	(0.045)	(0.038)
Never married	−0.341***	−0.148***	−0.341***	−0.233***	−0.341***	−0.119**	−0.158***	−0.203***
	(0.083)	(0.047)	(0.083)	(0.039)	(0.083)	(0.057)	(0.040)	(0.033)
Widowed	−0.231**	−0.095**	−0.231**	−0.128***	−0.231**	−0.098**	−0.109***	−0.120***
	(0.098)	(0.039)	(0.098)	(0.036)	(0.098)	(0.040)	(0.042)	(0.030)
Members aged below 4	0.607***	0.142***	0.607***	0.154***	0.607***	0.145***	0.285***	0.164***
	(0.072)	(0.030)	(0.072)	(0.027)	(0.072)	(0.029)	(0.031)	(0.021)
Members aged more than 65	0.285***	0.116***	0.285***	0.122***	0.285***	0.101***	0.133***	0.115***
	(0.065)	(0.024)	(0.065)	(0.020)	(0.065)	(0.025)	(0.024)	(0.016)
Self-employed	0.338***	0.188***	0.338***	0.142***	0.338***	0.171***	0.108***	0.121***
	(0.070)	(0.034)	(0.070)	(0.028)	(0.070)	(0.036)	(0.033)	(0.025)
Farmer	0.225**	0.084*	0.225**	0.037	0.225**	0.088*	0.098**	0.103***
	(0.112)	(0.049)	(0.112)	(0.047)	(0.112)	(0.050)	(0.050)	(0.039)
Unemployed	0.070	0.098	0.070	0.019	0.070	0.085	0.170***	0.147***
	(0.092)	(0.063)	(0.092)	(0.050)	(0.092)	(0.069)	(0.047)	(0.044)
Retired	0.351***	0.215***	0.351***	0.211***	0.351***	0.177***	0.209***	0.209***
	(0.075)	(0.037)	(0.075)	(0.030)	(0.075)	(0.042)	(0.033)	(0.025)
Other inactive	0.652***	0.250***	0.652***	0.235***	0.652***	0.200***	0.343***	0.237***
	(0.100)	(0.046)	(0.100)	(0.037)	(0.100)	(0.049)	(0.044)	(0.032)
Uninsured	0.488***	−0.010	0.488***	0.026	0.488***	−0.014	0.054	−0.145***
	(0.088)	(0.065)	(0.088)	(0.055)	(0.088)	(0.071)	(0.052)	(0.051)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−2.860***	2.898***	−2.860***	2.472***	−2.860***	2.721***	−3.693***	−0.129
	(0.743)	(0.300)	(0.743)	(0.266)	(0.743)	(0.350)	(0.631)	(0.407)
Observations	31,940	27,878	31,940	27,878	31,940	27,878	31,920	27,860

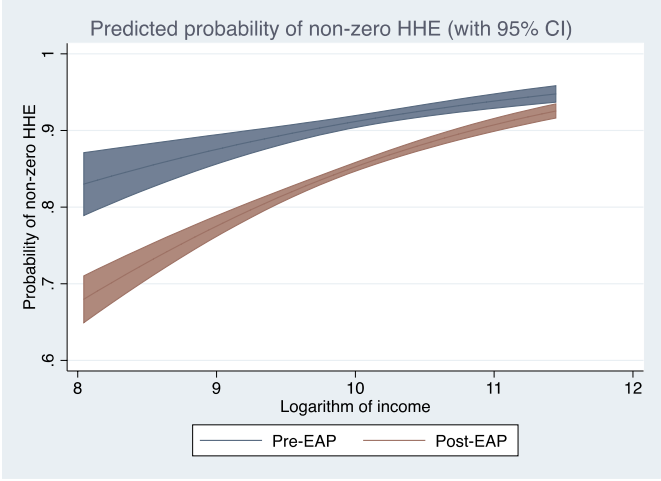

Fig. 2. Predicted probability of non-zero household health expenditure.

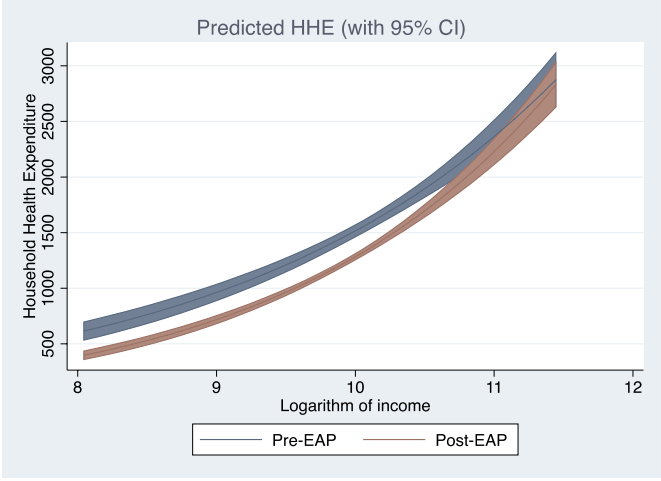

Fig. 3. Predicted level of household health expenditure.

Table 2
Income elasticity of household health expenditure.

	Total period	Pre-EAP	Post-EAP	Significant difference
Probability semi-elasticity				
Probability semi-elasticity	0.055 (0.004)	0.026 (0.005)	0.059 (0.004)	Yes
Unconditional income elasticity				
Main model TPM (logit, GLM Gamma)	0.54 (0.02)	0.45 (0.03)	0.56 (0.02)	Yes
TPM (logit, OLS)	0.52 (0.02)	0.43 (0.03)	0.54 (0.02)	Yes
TPM (logit, GLM Poisson)	0.64 (0.03)	0.47 (0.04)	0.68 (0.03)	Yes
GLM Gamma	0.54 (0.02)	0.45 (0.03)	0.57 (0.03)	Yes
OLS	0.46 (0.02)	0.41 (0.03)	0.48 (0.02)	Yes
GLM Poisson	0.64 (0.03)	0.49 (0.04)	0.70 (0.03)	Yes
2SLS	0.77 (0.04)	0.71 (0.04)	0.79 (0.04)	Yes

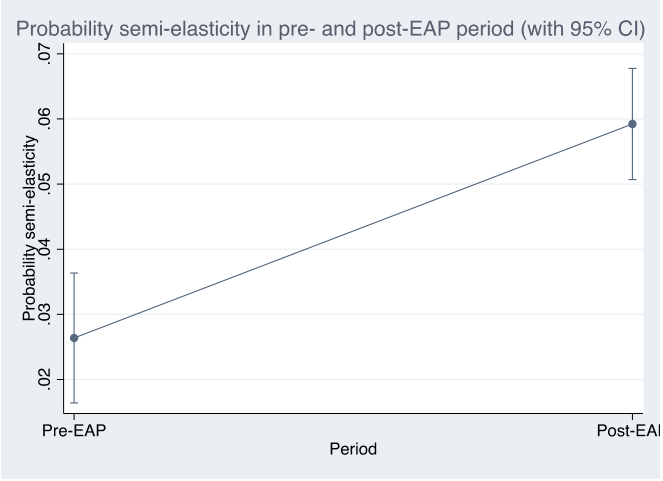

Fig. 4. Probability semi-elasticity of household health expenditure in pre- and post-EAP period (with 95% CI).

positive value. As expected, the numbers of household members aged under 4 and more than 65 years old are both positively associated with HHE. Finally, the predicted level of HHE is increasing with income and generally lower after the introduction of the EAP (Fig. 3).

5.3. Income elasticity of HHE

Following Mullahy (1998), we measure the responsiveness of HHE to income changes, using two measures. First, we estimate the probability semi-elasticity, which measures the absolute change in the probability of health care spending following a percentage change in income. As shown in Table 2, the probability semi-elasticity (evaluated at means) is 0.055.

We also estimate the probability semi-elasticity for the periods before and after the introduction of the EAP in Greece. We find a statistically significant increase in the probability semi-elasticity of HHE with respect to income after the introduction of the EAP, suggesting that an equal percentage change in income is associated with a greater change in the probability of spending after the EAP. As shown in Fig. 4, the probability semi-elasticity is 0.026 in the pre-EAP period and 0.059 in the post-EAP period.

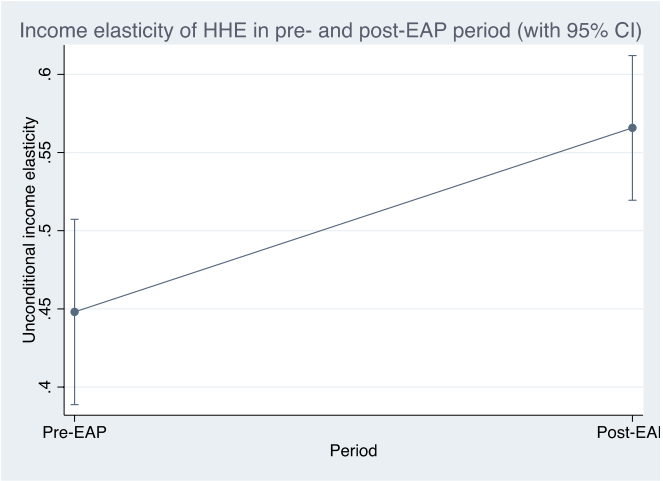

Fig. 5. Income elasticity of HHE in pre- and post-EAP period (with 95% CI).

Further, we provide evidence regarding the magnitude of the unconditional income elasticity of HHE, which captures both probability and conditional elasticity (given by the first and second parts of the MTPM, respectively) (Mullahy, 1998). In particular, the income elasticity of HHE is estimated as 0.54, suggesting that a 10% increase in income is associated with a 5.4% rise in HHE. Thus, the magnitude of the income elasticity indicates that health care is—in technical terms—a necessity. In addition, our analysis shows that income elasticity increased from 0.45 to 0.56 following the introduction of the EAP (Fig. 5). In the same vein, Table 2 shows that –after using an IV approach-income elasticity increases in the post-EAP period.

Overall, HHE is more responsive to income changes in the post-EAP period. Although these estimates rely on our baseline model, our results are robust to alternative models and estimation techniques, such as (a) TPM with log-transformed linear model as second part, (b) MTPM with GLM with Poisson family as second part, (c) several single-equation models. Using different models, the magnitude of the income elasticity of HHE is similar to the one derived from the main model (see Table 2), while –according to all models we estimated-there is also a statistically significant increase in income elasticity in the post-EAP period.

Apart from being robust to different modeling approaches, our findings are also insensitive and robust to the inclusion/exclusion of explanatory variables. For instance, if we estimate the baseline model without including education as a control variable, income elasticity amounts to 0.51 and 0.59 for the pre- and post-EAP period respectively, while the relevant figure for the total period is 0.57. We also test the robustness of our findings, after controlling for a quadratic term of income, and income elasticity is 0.56. In the pre-EAP period, it approximates 0.45, and increases to 0.60 in the post-EAP period. We estimate the elasticities using other empirical models and further confirm the baseline findings. More details can be found in the Online Supplementary File Table A7.

5.4. Income elasticity of HHE, by household type

Grouping households is interesting for our analysis since households of different SES may have different behavior towards HHE and may react differently to income changes. Examining income elasticity of HHE across household types therefore allows us to provide a more detailed and analytical overview of the way in which HHE responds to income changes.

To check the potential heterogeneity in income elasticity, we stratified the sample by the following household types: (a) the bottom 40% of the income distribution, (b) female household heads, (c) low-educated household heads, (d) unemployed household heads, (e) uninsured household heads, (f) no working household members, (g) households with unmarried mothers as the household head, and (h) elderly couples.

Table 3 presents the estimates of the income elasticity of HHE for different household types. The results are consistent with the findings presented in Section 5.3, confirming that health care is a necessity regardless of household type and SES. Moreover, our findings suggest heterogeneity across household types: HHE is more elastic for households with a higher SES. For instance, households in the bottom 40% of the income distribution have a lower income elasticity of HHE relative to households in the top 60%. Similar results are reported for households whose heads are women, low-educated, unemployed, or uninsured as well as for households with no working members.

Our results also suggest a significant increase (at the 5% level) in income elasticity between the pre- and post-EAP periods for the majority of the subgroups. However, there is no significant increase in income elasticity for socially less privileged population groups. Compared with the pre-EAP period, the higher socioeconomic strata become more responsive to income changes, whereas this is not the case for the lower socioeconomic groups. Therefore, a 10% change in income in the post-EAP period is associated with a higher percentage change for higher socioeconomic groups (compared with the pre-EAP period). We do not report similar findings for households of lower SES, which appear to retain the same sensitivity to income changes. This finding has various policy implications, as it indicates the differential responses in HHE across household types.

Table 3
Income elasticity of household health expenditure, by household type.

	Total period	Pre-EAP	Post-EAP	Significant difference (pre-post)
Income level				
Bottom 40%	0.29	0.40	0.26	No
	(0.04)	(0.07)	(0.05)	
Top 60%	0.75	0.59	0.79	Yes
	(0.04)	(0.06)	(0.04)	
Gender of household head				
Female	0.52	0.50	0.52	No
	(0.05)	(0.06)	(0.05)	
Male	0.54	0.43	0.58	Yes
	(0.02)	(0.04)	(0.03)	
Education of household head				
No formal education	0.49	0.34	0.52	No
	(0.06)	(0.10)	(0.06)	
Formal education	0.54	0.46	0.57	Yes
	(0.02)	(0.03)	(0.02)	
Employment status of household head				
Unemployed	0.46	0.52	0.47	No
	(0.06)	(0.15)	(0.06)	
Employed	0.55	0.45	0.58	Yes
	(0.02)	(0.03)	(0.03)	
Insurance status				
Uninsured	0.38	0.62	0.36	No
	(0.08)	(0.18)	(0.08)	
Insured	0.56	0.45	0.59	Yes
	(0.02)	(0.03)	(0.02)	
Working members				
No working members	0.40	0.30	0.42	No
	(0.04)	(0.06)	(0.04)	
Other type	0.64	0.46	0.68	Yes
	(0.03)	(0.06)	(0.03)	
Unmarried mother				
Unmarried mother	0.63	0.59	0.74	No
	(0.08)	(0.10)	(0.11)	
Other type	0.53	0.42	0.56	Yes
	(0.02)	(0.03)	(0.02)	
Elderly couple				
Elderly couple	0.42	0.44	0.41	No
	(0.04)	(0.09)	(0.05)	
Other	0.55	0.45	0.59	Yes
	(0.02)	(0.03)	(0.03)	

Table 4
Income elasticity of household health expenditure, by level of household health expenditure.

Quantile of HHE distribution	Total period	Pre-EAP	Post-EAP	Significant difference
0.10	0.36	0.40	0.35	No
	(0.03)	(0.05)	(0.03)	
0.20	0.39	0.35	0.40	No
	(0.03)	(0.04)	(0.03)	
0.30	0.43	0.41	0.43	No
	(0.02)	(0.03)	(0.02)	
0.40	0.44	0.44	0.44	No
	(0.02)	(0.03)	(0.02)	
0.50	0.48	0.46	0.49	No
	(0.02)	(0.03)	(0.02)	
0.60	0.51	0.45	0.53	Yes
	(0.02)	(0.03)	(0.02)	
0.70	0.50	0.42	0.53	Yes
	(0.02)	(0.03)	(0.02)	
0.80	0.50	0.40	0.54	Yes
	(0.02)	(0.03)	(0.02)	
0.90	0.50	0.43	0.53	Yes
	(0.02)	(0.03)	(0.02)	

Table 5
Income elasticity of household health expenditure (proxies for permanent income).

Model	Welfare measure	Total period	Pre-EAP	Post-EAP	Significant difference
TPM (logit, GLM Gamma)	Log expenditure	0.92 (0.02)	0.75 (0.03)	0.97 (0.02)	Yes
TPM (logit, GLM Gamma)	CWI	1.09 (0.03)	0.83 (0.04)	1.17 (0.03)	Yes

5.5. Income elasticity of HHE, by the level of HHE

The previous analysis focused on modeling HHE by using a conditional mean function. We also examined the potential heterogeneity in the income elasticity of HHE at different points of the conditional distribution of the response variable. By focusing on the non-zero observations of the HHE distribution, we ran quantile regressions at different points, finding that the income elasticity of HHE is positive and below unity; in other words, health care is a necessity across all quantiles of the HHE distribution (see Table 4). However, the size of the elasticity differs across these quantiles, as it is more income inelastic for households having relatively low HHE. Income elasticity is lower in the 0.10 quintile and gradually increases until the 0.60 quantile. In addition, it is relatively constant across the 0.70–0.90 quintiles.

In addition, we find a statistically significant increase in income elasticity for the higher quintiles (0.60–0.90 quintiles), whereas this is not the case for the lower quintiles. This finding is consistent with those reported in Section 5.4 since those in the lowest quintiles of the HHE distribution are less privileged socioeconomic groups, for which we do not report an increase in the income elasticity of HHE.

5.6. Using alternative measures of household welfare

Household spending decisions are often based on long-run resources rather than current income. For instance, households may decide to liquidate assets, use savings, or bear additional debt to incur OOPE for health care. In this context, the elasticity with respect to permanent income might be different compared with the one with respect to current income. By using two alternative measures of a household's financial situation (i.e., consumption expenditure and the CWI) and based on additional models (Online Supplementary File Tables A9 and A10), we thus test the fourth hypothesis of this study. Our findings suggest that the permanent income elasticity of HHE is consistently greater than the current income elasticity, suggesting that HHE responses to permanent income changes are greater than those arising from current income changes (Table 5). This finding is robust when using either consumption or the CWI, both of which can better capture the notion of "permanent income" (Meyer and Sullivan, 2003; Mitrakos and Tsakloglou, 2010).

By using the alternative measures of a household's financial situation, we find that the income elasticity of HHE is consistently higher after the introduction of the EAP across empirical models and estimation methods. These findings further confirm our first hypothesis regarding the increased income elasticity of HHE in the post-EAP period since they suggest that this finding is robust even when using alternative measures of household welfare.

6. Discussion

Using household data from repeated cross-sections over 2008–2015, our analysis identifies the determinants of HHE and examines potential changes in the income sensitivity of HHE and consumer behavior following a severe economic crisis and the introduction of a large-scale EAP. The regression estimates suggest that the introduction of the EAP is significantly associated with a lower probability of health care spending and lower HHE. Further, we find that the introduction of the EAP modifies the association between income and HHE.

Our analysis reveals that the income elasticity of HHE is below unity, suggesting that health care is a technical necessity. In other words, HHE increases (decreases) less than proportionally in response to an income increase (decrease). This finding is generally consistent with the vast majority of the literature using micro-data (Getzen, 2000). The size of our estimate can be attributed to the lack of adequate prepayment mechanisms and the high OOPE in Greece, not only as a percentage of total health expenditure but also as a fraction of the household budget (OECD/EU, 2016). In a review of the literature, Getzen (2000) indeed notes that evidence suggests that income elasticity tends to be somewhat greater –ranging from 0.2 to 0.7- in cases where *"insurance is less prevalent and most payment is made out of pocket"* (Getzen, 2000). The results are generally robust across econometric specifications, and indicate that HHE is not a voluntary and deliberate choice (Lépine, 2015). Rather, it is related to either health shocks or households' responses to gaining access to health care in the context of a fragmented health system that does not ensure the accessible and timely provision of high-quality care (Davaki and Mossialos, 2005; Economou, 2010).

Examining whether health care is a necessity or luxury has significant implications from a public policy perspective, especially regarding health financing. For instance, if health care is indeed a necessity, then there are further grounds and arguments for more active public involvement in health financing and in the health care system more generally (Baltagi et al., 2017; Costa-Font et al., 2011; Gertler and Hammer, 1997). On the contrary, evidence in favor of the hypothesis that health care is a luxury suggests weaker public intervention in health financing and coverage and a greater role for market forces (Di Matteo, 2005).

In terms of Hypothesis 1, our analysis indicates a statistically significant increase in the income elasticity of HHE between the pre- and post-EAP periods (from 0.45 to 0.56). Households are more responsive to income changes after the introduction of the EAP, and this finding is robust across econometric specifications. Furthermore, it is in line with other studies that have found that the income elasticity of HHE increased after the 1997 economic crisis in Thailand and Korea (Okunade et al., 2010; Yang et al., 2001). In contrast to the crises in Thailand and Korea, the Greek crisis was much stronger in terms of length and intensity. We also show a significant increase in the probability semi-elasticity of HHE with respect to income, suggesting that a proportionally similar change in income is associated with a higher change in the probability of incurring HHE in the post-EAP period (relative to the pre-EAP period). Therefore, it appears that households' decisions to spend on health care as well as the level of HHE became more sensitive to income changes after the introduction of the EAP. These findings imply a change in household behavior towards health care, since households appear to exhibit greater consumption responses to changes in their income during the post-EAP period.

This finding can be further explained from a theoretical perspective. One explanation for the greater income sensitivity is associated with the unnecessary use of and non-essential payments for health care. In particular, households may decide to reduce OOPE for non-essential health care goods and services after an economic crisis (like they may reduce expenses for restaurants or clothing), as a response to increasing financial difficulties (Yang et al., 2001). Second, households may become more sensitive to income changes since they normally reduce their HHE and shift towards public services during periods of economic distress because of their reduced purchasing power and ability to pay OOPE (Waters et al., 2003; Yang et al., 2001). This is indeed depicted in the increase in hospital admissions, outpatient visits, and laboratory tests in public health services after the introduction of the EAP (Institute of Social and Preventive Medicine, 2016; Kentikelenis and

Papanicolas, 2012). Our findings confirm that households continue to consider health care to be a necessity. They also suggest that different priorities and preferences exist regarding the consumption of health care and HHE in the post-EAP period. OOPE for health care is more elastic and generally considered to be less "necessary" in the post-EAP period given the alternative of using public services.

To examine Hypothesis 2, we estimated the income elasticity of HHE by household type. While HHE is generally income inelastic across all household types, we did find heterogeneous responses of HHE to income changes based on households' SES or degree of vulnerability. In particular, HHE is more inelastic for lower SES households. Overall, lower socioeconomic groups exhibit lower flexibility in HHE as income changes than higher socioeconomic strata. Based on a descriptive analysis of the Greek HBS data for 2005 and 2009, another study also reported that HHE is more inelastic among low-income households because of the relatively inflexible need for care (Kondilis et al., 2013). Our finding can be explained on the basis of the different mixes of medical goods and services consumed by each socioeconomic group and their relative costs. For instance, the HHE of less privileged households primarily consists of payments for pharmaceuticals (i.e., user charges and payments for non-reimbursed medicines), while they tend to incur lower expenses for hospital/outpatient visits and dental care. These combinations of health care goods and services might result in heterogeneous consumption responses to income changes since the expenses for some health care goods and services (e.g., cost-sharing for medicines) are more essential and cannot be easily avoided or substituted by shifting to the public sector.

In addition, the heterogeneity in income elasticity can be attributed to several structural barriers to accessing health care for the poorer segments of society. This result highlights the need for progressive policies that aim for equity health care access and financing (Zare et al., 2013). Several barriers impede access to health care in Greece, especially for the most vulnerable groups (Kyriopoulos et al., 2014; Zavras et al., 2016). In this context, appropriate public policy responses are needed, especially for less privileged households. Further, the lower income sensitivity of HHE among lower socioeconomic groups can be interpreted on the basis of the socioeconomic gradient in health and the fact that poorer individuals tend to have lower health status and greater health care needs.

In terms of Hypothesis 3, contrary to higher socioeconomic groups, less privileged households did not become more sensitive to income changes in the post-EAP period. As pointed out above, households often shift to public services and avoid OOPE for some types of health care because of reduced disposable income (Yang et al., 2001). However, such mechanisms cannot work for certain types of OOPE. In particular, there is no substitute (in the public sector) for user charges, which constitute a prerequisite for gaining access to certain health care. For instance, cost-sharing schemes in pharmaceutical care imply that individuals should pay user charges to receive and adhere to their therapy. Households whose HHE primarily consists of payments for pharmaceuticals (or user charges more generally) did not become more sensitive to income changes because their HHE is relatively rigid. Poor households appear to be more "protective" about their health care consumption compared with richer ones, and this intensified in the post-EAP, during which HHE became more elastic for higher socioeconomic groups, but not for less privileged households. This relative "rigidity" of poorer households as income changes combined with the high share of income devoted to health care raises concerns about the implications of the EAP on household welfare because of the increased incidence of catastrophic expenditure at the household level. Given the budget constraints faced by poorer households, such a finding illustrates that they may cut spending on other goods and services than that for health following an income decrease, and they thus have lower income elasticity (compared with overall elasticity).

Further, HHE is income inelastic over its conditional distribution. However, the quantile regression estimates show that HHE is more income inelastic in the lower quantiles of the HHE distribution. A statistically significant increase in the income elasticity of HHE is only observed in the top quantiles of the HHE distribution (0.6–0.9 quintiles), suggesting that contrary to those at the bottom, "big spenders" are those who actually became more sensitive to income changes during the post-EAP period. This finding serves as an additional robustness check to the aforementioned findings, as households in the lower quantiles are expected to be lower socioeconomic groups (neither of which exhibited a statistically significant increase in income elasticity between the pre- and post-EAP periods).

Finally, Hypothesis 4 related to income sensitivity with respect to permanent income. To our knowledge, this is the first study examining how HHE responds to current and permanent income and identifying potential differences depending on the welfare measure used. Measures of permanent income are particularly important to better understand households' health care consumption since households tend to smooth consumption over their lifetime and their consumption decisions are rather based on permanent income or the notion of lifetime wealth than current income (Friedman, 1957). Transitory income changes tend to have only small effects on consumption, whereas permanent shocks are associated with greater consumption responses (Jappelli and Pistaferri, 2010). We show that the size of income elasticity is greater when using more permanent measures of welfare. In other words, HHE responses to permanent income are greater than those arising from variations in current income. In addition, by using consumption expenditure and the CWI, we present strong evidence of greater income sensitivity in the post-EAP period, a finding that further validates our baseline results.

Finally, our study has some limitations. First, the aggregate nature of the EAP as well as the cross-sectional design of the surveys do not allow us to employ quasi-experimental approaches or estimate the causal effects. Therefore, the interpretation of associations as causal relationships should be made with caution. Second, our model does not include a health variable. This is a common limitation in studies using household data (Amuedo-Dorantes and Pozo, 2011; Okunade et al., 2010; Zare et al., 2013), since it is practically difficult to approximate health status at the household level and most budget surveys do not ask questions about health status. However, we control for proxies for the need for health care at the household level, especially those groups considered to be heavy health care users. Third, this analysis relies on household-level survey data, and our estimates thus capture partial health expenditure (i.e. the out-of-pocket expenditure). Last, the impact of each of the "triple hits" cannot be isolated and tested separately, due to lack of relevant data.

7. Conclusion

The unprecedented length and intensity of the Greek crisis as well as the magnitude of the fiscal adjustment make this case particularly interesting in several respects. In particular, Greek households experienced the "triple hit" of public budget cuts, increased user charges, and a large decrease in disposable income and household purchasing power. The presented analysis of how households behaved in the face of this economic shock (and the associated "triple hit") suggests that the introduction of the EAP is associated with a lower probability of health care spending and lower HHE. Apart from the regression estimates, we show that households became more sensitive to income changes after the introduction of the EAP. We also find heterogeneity in the income elasticity of HHE across household types and over the HHE distribution as well as show that lower SES households did not become more sensitive to income changes after the onset of the economic crisis. Lastly, by using a novel proxy for permanent income, our findings suggest that HHE responses to permanent income changes are greater than those arising from current income changes. From a public policy perspective, this study provides evidence and informs policymaking about households' behavior towards health care, health financing, and the design of social safety nets.

Our findings have several policy implications. Estimating the income sensitivity of HHE is useful for evidence-based health policy because it thoroughly informs policymaking about resource allocation decisions and financing (Lépine, 2015; Zare et al., 2013) and allows governments to improve the design of social safety net programs aiming to protect the vulnerable from structural adjustments (Rous and Hotchkiss, 2003). Low income elasticity provides grounds for public policy responses and interventions that aim to reduce the OOP price through subsidies or abolish cost-sharing mechanisms for lower socio-economic groups, which are less responsive to income changes (Zare et al., 2013). Based on our findings, and considering that health financing in Greece largely relies on OOPE, a potential policy response could incorporate exemptions from user charges for vulnerable households or income-related user charges. The introduction of such a scheme would improve equity in financing by reducing the financial burden of OOPE for less privileged households, leading to higher progressivity in health financing. Although the introduction of income-related user charges constitutes the "first-best solution", it incorporates several practical problems and difficulties (Barros, 2012). First, the implementation of this system is associated with high administrative costs and might be complicated. Second, there is a dearth of data on actual income in Greece because of high levels of informal activity, deficiencies in the tax system, and tax evasion, which lead to significant distributional effects (Matsaganis and Flevotomou, 2010). Therefore, relying on tax data for introducing differential user charges may be misleading. Such a problem clearly threatens the objective of this system (i.e., to establish equity and higher progressivity in health financing). Instead of such a complicated scheme, another policy response could simply promote reductions in the OOP price (e.g. subsidies or abolish cost-sharing mechanisms) for specific types of households with a low ability to pay. In addition, our findings highlight the need to protect basic health care, especially during prolonged economic recessions. This appears to be necessary in order to preserve adequate human health capital for investment and consumption, which in turn can be catalysts for triggering economic recovery and also improve labour productivity.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2019.01.021.

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