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# **Does tobacco spending crowd-out the household budget? Preliminary results using nationwide survey data**

by

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## **Abstract**

The aim of this paper is to examine the crowding out effect of tobacco spending on other household commodity groups. It uses a national representative household sample survey retrieved from Hellenic Statistical Authority for the year 2017. A system of conditional Engel curve formula was estimated for a set of 12 commodity groups based on Eurostat categorization. Results reveal that spending on tobacco leads to a household budget allocation having a negative effect on certain commodity groups such as food, clothes, health and durables and positive on communication, education and spending on hotels and restaurants. Policy implications suggest that a regressive policy recommendation that result a cut tobacco effect could lead to a better wellbeing and household health status with a more sustainable consuming behavior.

*Keywords:* Tobacco; Crowd out; Greece; Expenditure

## **1. Introduction**

Tobacco is not only unhealthy but it can also drive out other households expenditures, including basic needs. Previous studies (Escario and Molina, 2001) have shown that the addiction may be not the result of myopic consumer behavior but rather of maximization of total consumer utility. However, tobacco consumption leads to crowding out effects to other household expenditures. This crowd out effect is mainly observed among low-income families, affecting not only the smoker but the rest of the people in the household ( Hickling and Miller, 2008; Raniet al., 2003; Wanget al., 2006). The main idea is that given a fixed budget, any spending on tobacco will certainly result in a reduction of expenditure on other goods and services. In literature, there is a number of empirical evidence that present how tobacco consumption actually crowds out the consumption of other categories of goods affecting also the well-being of household (Aristei and Pieroni, 2008; Bush et al., 2004; Efroymsen et al., 2001; Gupta and Ray, 2003; Nicolas and Dominguez, 2006; Sindelar and O'Malley, 2014; Shah and Vaite, 2002). Another strand of literature has focused its interest in the relationship between tobacco and alcohol consumption as two highly social addictive substances ( Bonu et al., 2004; De Silva et al., 2011; Neufeld et al., 2005; Zhou et al., 2006) while others adding to these have also highlighted that tobacco spending might impact on health, environment, poverty and child poverty ( Bonuet al., 2004; Krause, 2009; Thomson et al., 2002; WHO, 2004) creating a vicious circle among these issues. This survey takes the case of Greece to examine the issues of crowding out and impoverishment for a variety of reasons. First, the country has passed a period of economic recession leading many people to have many psychological issues and an increased rate of suicides (Antonakakis and Collins, 2015). At the same time, changing financial circumstances and legislation for tobacco control seem to have influenced the intention to quit smoking among the Greek population (Schoretsaniti et al., 2014). It is worth noting that Greece is one country with many smokers who based on general knowledge disobey the law of tobacco forbiddance in public and closed places even if it is existed since 2002 whereas tobacco's contributions to the economy are usually outweighed by its human costs to households, health and to environment. Only recently the situation seems to change. At the same time, the proportion of daily smokers in Greece (and Bulgaria) is the highest in EU with

27% while they are the heaviest smokers in Europe (15.1% smoke more than 20 cigarettes per day) based on latest available data of Eurostat<sup>1</sup>. The main objective of this paper is to study the impact of tobacco spending on other family budget shares based on the most recent available data in the country. Following the previous literature, we next examine this opportunity cost of tobacco while controlling for observable demographic characteristics. This will help us to underline the need for more effective policy intervention by the policymakers in order individuals to quit tobacco. A strategy like this not only would improve population health (*health impact*) but also can reduce the impact on households' poverty (*financial impact*). The rest of the paper is organized as follows. Section 2 briefly presents the data and the methodology. Section 3 gives an empirical overview of the findings. In section 4, policy implications for tobacco crowding effect is discussed followed by a concluding part.

## 2. Data and methodology

### 2.1. Data

Household cross section data from the Hellenic Statistical Authority (HAS) collected in 2017. The data contain information on demographic characteristics and on consumption for a wide variety of goods from 6,176 households spread across 13 counties in Greece. Expenditures on 12 distinct categories (Eurostat categorization) including food, education, healthcare, transportation and entertainment were considered for the analysis in this article. For a better investigation, a categorical variable divided the sample into three income groups was created: households with low, middle, and high income based on the distribution of per capita annual expenditures for each household. Households above the 70th percentile of the distribution of per capita expenditures are classified as high-income, those below the 30th percentile of the distribution as low-income while the ones in between are classified as middle-income.

### 2.2. Methodology

The main idea of our microeconomic analysis is based on the conditional Marshallian demand function through each household would maximize its utility function:

$$\text{Max}U = u(q_1, q_2, \dots, q_n; a) \quad \text{subject to: } \sum_{i=1}^n p_i q_i = \check{q} \quad \text{Eq.1}$$

where  $\check{q}$  denotes the household's demand for tobacco. Proceeding to the econometric estimation of the crowding out effect, the empirical implementation of the model is based on the conditional Engel curve that takes the following form for the goods  $i$  and  $j$  respectively:

$$w_{ij} = a_{1i} + a_{2i} p_{nj} q_{nj} + \delta_i h_j + \beta_{1i} \ln M_j + \beta_{2i} (\ln M_j)^2 + u_{ij} \quad \text{Eq.2}$$

Where  $w_{ij}$  is the budget share allocated by  $j$  household to the  $i$  commodity group out of the remaining budget ( $M$ ) after deducting the expenditures on tobacco,  $p_j q_j$  in the expenditure on tobacco,  $h$  is the vector of households characteristics allowing the heterogeneity issue,  $\ln M$  and  $\ln M^2$  are the natural logarithms of the expenditure after deducting the expenses on tobacco while  $u_i$  is the disturbance term. Next, based on previous literature<sup>2</sup>, a categorical variable which takes the value 1 if households spend any money on tobacco and 0 otherwise was created. The main reason for including this dummy in the model is that zero expenditure on tobacco arises from a corner solution. Thereafter, a statistical test of the equality of mean budget shares in all categories expenditures between tobacco spenders and non-spenders was

<sup>1</sup>[https://ec.europa.eu/eurostat/statistics-explained/index.php/Tobacco\\_consumption\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php/Tobacco_consumption_statistics)

<sup>2</sup>For example, for more information about the procedure please see the following papers of (John, 2008) or (Wang et al., 2006).

employed. In a deeper analysis, specific econometric equations investigating the crowding out impact on households' budget were estimated. More generally, empirical surveys on crowding out effect mostly use the QAIDS approach. However, since direct price information is not available for different commodity groups from household surveys, Engel curves, which allow work with expenditures, were used for the econometric specification. Based on this specification and as empirical literature indicates, a set of demographic characteristics of the household was used as endogenous and instruments indicators including<sup>3</sup>: (a), the log of the household size (b) the ratio of number of adults (14 years or older) to household size (c) the average education (total education received by all the members in years divided by the household size) of the household, (d) the years of education received by the most educated member in the household and (e) several dummies for different social and occupational groups. Nevertheless, there is not a unique procedure and method for this estimation. In our case, a GMM 2SLS system estimation controlling for errors correlation was estimated and several econometric criteria such as the tests for endogeneity, heretogeneity, exogeneity of the instruments and overidentification issues were employed.

### 3. Empirical results

Table 1 presents a summary of budget shares allocated to the bunch of commodities by tobacco consumption status of households and for different income groups in Greece. The middle-income group represents households between the 30<sup>th</sup> and 70<sup>th</sup> percentile of the distribution of annual gross income. Higher and lower income groups are those above and below this range respectively.

Table 1: Summary statistics by income level

	All households	Non-smokers	Smokers
Tobacco			
<i>Low-income</i>	2.2%	-	-
<i>Middle income</i>	2.1%		
<i>High income</i>	2.2%		
Food			
<i>Low-income</i>	25.3%	26.0%	26.2%
<i>Middle income</i>	20.8%	21.3%	21.0%
<i>High income</i>	15.9%	16.3%	15.4%
Clothes			
<i>Low-income</i>	2.6%	2.6%	3.0%
<i>Middle income</i>	3.6%	3.6%	4.1%
<i>High income</i>	4.7%	4.7%	5.7%
Housing			
<i>Low-income</i>	37.2%	37.8%	35.1%
<i>Middle income</i>	35.4%	36.8%	31.5%
<i>High income</i>	30.8%	32.5%	28.3%
Durables			
<i>Low-income</i>	2.4%	2.5%	2.5%
<i>Middle income</i>	3.1%	3.2%	2.9%
<i>High income</i>	4.7%	5.5%	3.7%
Health			
<i>Low-income</i>	5.2%	5.0%	4.6%
<i>Middle income</i>	6.2%	3.4%	4.9%
<i>High income</i>	7.0%	7.7%	5.8%
Transportation			
<i>Low-income</i>	5.6%	5.9%	7.0%
<i>Middle income</i>	6.8%	7.0%	8.9%

<sup>3</sup> See notes in Table 3.

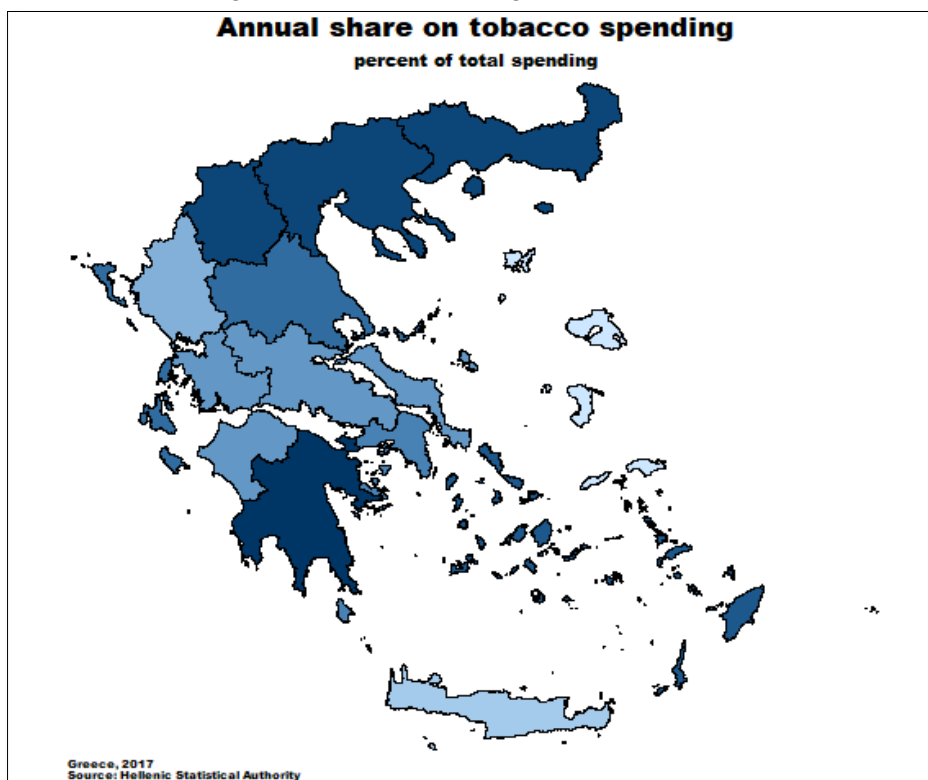
<i>High income</i>	9.0%	8.5%	11.2%
Communication			
<i>Low-income</i>	4.2%	4.3%	4.5%
<i>Middle income</i>	3.8%	3.9%	4.2%
<i>High income</i>	3.2%	3.3%	3.5%
Entertainment			
<i>Low-income</i>	1.9%	1.9%	2.2%
<i>Middle income</i>	2.6%	2.5%	3.1%
<i>High income</i>	4.0	3.8%	4.8%
Education			
<i>Low-income</i>	1.8%	2.0%	2.0%
<i>Middle income</i>	1.5%	1.6%	2.5%
<i>High income</i>	1.5%	1.7%	2.1%
Hotels/Restaurants			
<i>Low-income</i>		6.7%	7.2%
<i>Middle income</i>	6.5%	8.2%	10.1%
<i>High income</i>	8.2%	9.4%	12.5%
Others			
<i>Low-income</i>	4.4%	4.5%	4.8%
<i>Middle income</i>	4.8%	4.8%	5.4%
<i>High income</i>	5.7%	5.8%	5.9%

Source: Hellenic Statistic Authority; Authors' calculations.

The descriptive analysis shows that budget share allocation varies both by tobacco spending status and by income level. In general, households devote around 2.2% of their total expenditures on tobacco purchases (4.9% of total household expenditure for both alcohol and tobacco is devoted based on Eurostat<sup>4</sup>). Regarding the rest of the commodity groups, it is revealed that food, housing, health and durables shares are much lower in tobacco spending households than in no-tobacco spending ones. Especially for health, results show that even smokers are more prone to face healthy issues on the future, they sacrifice money from this service by being tobacco spenders. In general, the aforementioned results indicate clearly that when households spend higher expenditures on tobacco, they spend relatively less in some other areas. On the contrary, based on budget share allocation, the tobacco spending crowding-in theory is supported for entertainment, communication, transportation, education and hotels/restaurants. Simultaneously, it is obvious in the majority of commodities that higher levels of income lead to an increase in expenditure shares. On the contrast, low-income households consume on average 26% of their expenditures on food items whereas high-income households devote around 10% lower on food confirming the Engel's law. Similar results are shown for health, durables, entertainment, etc. Furthermore, even if the present paper does not analyze results for region-specific crowding out analysis, it would be high of interest to see descriptively the budget share of tobacco spending across regions (NUTS II). Figure 1 presents this variability across counties in Greece.

<sup>4</sup> <https://ec.europa.eu/eurostat/news/themes-in-the-spotlight/household-expenditure-2017>

Figure 1: Households budget share for tobacco



As it can be noticed, regions from north Greece are more probable to devote a higher share of their expenditure on tobacco while households from North Aegean and Crete have very low levels of spending for tobacco. For example, in absolute values, households from Central Macedonia spend on annual average 512 Euro for tobacco while North Aegean only 228 Euro annually. It seems that there should be several socioeconomic or lifecycle characteristics that play major role on this finding. Thereafter, Table 2 gives the results of Student's t-test for the differences in mean budget share of expenditures between the non-tobacco consuming and tobacco spending households.

Table 2: Student's t-test for the differences

Categories	Difference	t-stat
Food	2.4%	11.101**
Clothes	0.5%	5.153**
Housing	6.9%	21.410**
Durables	0.8%	6.812**
Health	1.8%	9.747**
Transportation	-1.8%	-8.713**
Communication	0.01%	1.584
Entertainment	-0.6%	-6.239**
Education	-0.5%	-4.684**
Hotels/Restaurants	-1.7%	-8.301**
Others	-0.2%	-1.706*

Notes: difference shows 'mean of budget share of non-users' - 'mean of users'. \*\* and \* denote significance at 5% and 10% level, respectively. t-Stat shows the Student t-statistics for the  $H_0$ : mean (non-users) - mean (users)=0 for each of the commodity goods.

It is observable that statistically significant differences in budget shares exist between tobacco consumers and non-tobacco consumers in all expenditure except communication services.

Food and housing expenditure are considerably higher among the tobacco spending households indicating the different allocation for households' nutrition intake and the potential links between tobacco consumption and housing choice decisions. In contrast, entertainment, transportation, education expenditure and expenditure on hotels and restaurants are lower among non-tobacco spenders. However, this result cannot be taken as a causal effect from education to tobacco use. At the same time, the situation in Greece with high rates of unemployment among high-educated persons and the big need for people to go out and feel better could explain this result. This kind of research could be interesting for future research. Table 3 presents the crowding out effects of tobacco using GMM estimation for households irrespective of their income levels.

Table 3: Crowding out effects of tobacco (GMM 2SLS) for households irrespective of their income levels (N=6,176).

Dependent variables	Coefficients of independent variables				Tests for endogeneity	Test for exclusion restriction	Test for heteroskedasticity
	d	pt	lnM	lnM <sup>2</sup>	Durbin Wu-Hausman	Sargan Basmann	Pagan-Hall
Food	0.581* (1.69)	-0.001* (-1.84)	-0.357 (-1.03)	0.020 (1.00)	85.124** 22.526**	53.12** 53.48**	1.516
Clothes	0.227* (1.67)	-0.0001* (-1.82)	-0.243* (-1.78)	0.016** (2.04)	75.785** 21.456**	38.098** 38.266**	1.213
Housing	0.054 (0.26)	-0.000 (-1.41)	-0.489* (-2.30)	0.022* (1.80)	41.370** 10.711**	18.343** 18.365**	2.830
Durables	0.255* (1.66)	-0.001* (-1.83)	-0.115 (-0.74)	0.010 (1.07)	92.329** 23.375**	31.318** 31.421**	2.700
Health	0.392 (1.58)	-0.0003* (-1.83)	-0.371 (-1.48)	0.025 (1.70)	43.090** 10.822**	21.739** 21.776**	1.636
Transportation	-0.075 (-0.50)	0.001 (1.43)	0.051 (0.34)	-0.002 (-0.32)	38.025** 9.363**	0.511 0.511	7.358
Communication	-0.112* (-1.94)	0.0001* (1.75)	0.120** (2.06)	-0.008** (-2.25)	55.413** 14.100*	32.551** 32.665**	2.451
Entertainment	0.001 (0.01)	0.000 (0.57)	-0.163*** (-3.51)	0.009*** (3.41)	27.198** 7.140**	62.789** 63.321**	53.340*
Education	-0.350** (-2.14)	0.0002* (1.77)	0.305* (1.85)	-0.017* (-1.76)	8.005* 2.011*	42.779** 43.001**	3.243
Hotels/Restaurants	-1.205 (-1.49)	0.001* (1.91)	0.287 (1.58)	-0.079* (-1.69)	41.134** 9.989**	26.269** 26.334**	1.781
Others	0.231 (1.52)	-0.0002* (-1.85)	-0.056 (-0.34)	0.007 (0.73)	64.243** 16.190**	29.718** 29.809**	1.390

Notes: Dependent variable: Expenditure share for each commodity group. Instrumental variables:  $hsize$ ,  $meaneage$ ,  $maxedu$ ,  $urban$ ,  $private$ . Instruments:  $menratio$ ,  $adulratio$ ,  $lnX$ ,  $lnX^2$ . T-statistics in parenthesis. \*\*\*, \*\* and \* denote significance at 1%, 5% and 10% level, respectively. Test for validity of the instruments: F-Stat=47.359\*\*.

Table 3 presents the crowding out impact of tobacco on the rest of household budget commodity groups<sup>5</sup> based on system GMM estimations. Results shows that consumption of housing, transportation, entertainment and others are not separable from consumption of tobacco as “d” variable is insignificant. On the other hand, a change in tobacco spending within a household leads to both an income and substitution effect on goods such as food, clothes, health, education and hotels/restaurants. More specifically, an increase in tobacco spending leads to a fall in the budget share devoted to food, clothes, durables and health while it leads to an increase in share devoted to communication, education and hotels/restaurants. Regarding the robustness tests, the null hypotheses of the endogeneity tests (Durbin-Wu and Hausman tests) is that the variables are exogenous. The significant test indicates that the variables should be treated as endogenous as we followed. The results of F-statistics shows the validity of

<sup>5</sup> Commodity groups are not classified into basic and luxury goods and services since it is beyond the aim of this paper.

instruments while the test of heteroscedasticity (Pagan-Hall) confirms that homoskedasticity in the disturbance term is evident. Overall, the total of the robustness tests confirm that our variables were correctly included as endogenous while errors are i.i.d.

## **5. Concluding remarks and policy implications**

The present study uses a national representative household survey dataset in order to investigate the crowding out effect of tobacco spending on household budget allocation in Greece. As the study presents, it is shown that tobacco spending comes with household budget allocation among several commodity groups. Tobacco vs no-tobacco households seem to behave differentially leading to several concerns regarding the household sustainability of its budget preferences and individuals health consequences. For this purpose, we followed the framework of the conditional Engel curve estimating the effect of tobacco spending on the rest of the commodity groups. It was found that changes in tobacco spending lead to households' budget allocation against food, clothes, health and durables. On the contrary, increases in education, communication and expenses in hotels/restaurants are emerged after a raise in tobacco spending within a household. However, the survey has some limitations. First, the availability of detailed consumption data at the individual level would permit more advanced analysis. Also, it is possible data reported might suffer from measurement errors as they are based on self-reported information and in annual level. It is expected for instance that smokers underestimate their tobacco spending. Furthermore, a dynamic analysis of the data can give several and important discrepancies among households as time passes that a static model (cross-sectional) cannot capture it. Another limitation is that the used datasets do not include in-kind consumption not capturing for instance food produced by themselves. Nevertheless, despite the limitations, this survey is the first analysis that gives some preliminary quantified findings as to way that tobacco spending might impact on household budget allocation in Greece after the recession recovery. At the same time, the most important implication of this analysis in this survey is that confirming previous literature, each policy recommendation that leads to increased tobacco consumption leads to adverse impact on other basic household needs such as food and health. Alternatively, a regressive policy recommendation that result a cut tobacco effect leads to a better wellbeing and household health status with a more sustainable and orthodox consuming behavior. For instance, financial motivations, tax-policies or even a tobacco ban implementation might be particularly strong for households. On top of that, the knowledge of these budgetary effects provides additional information that might be useful for starting promoting tobacco cessation. Thus, a further analysis using dynamic data will leave ample room for a more advanced methodological approach and even more interesting findings. It is known that the household consuming behavior is not static and is changing through time. For instance, knowledge and information are cumulatively increasing and could have a major impact on consuming behavior. At the same time, it will be worth noting to show why some regions devote a much higher share of their households' budget for tobacco than others. It is possible that several socioeconomic characteristics and lifecycle attitudes such as unemployment rate or average income levels that are very different among Greek regions to be important factors that lead to higher tobacco rates in these areas (for instance North Greece).

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