

Crowding-out effect of tobacco expenditure in Vietnam

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ABSTRACT

Purpose This study aims at analysing the causal crowding-out effect of tobacco spending on intrahousehold budget share in Vietnam. Besides, we also examine the differences in expenditure patterns between tobacco spending households and non-spending households in Vietnam as well as determine the reason behind these differences.

Methods We estimated a system of quadratic conditional Engel curve to determine intrahousehold resource allocation using the latest Vietnam Household Living Standard Survey data in 2016. In order to estimate the causal crowding-out effect of tobacco spending, GMM 3SLS method is used to simultaneously deal with heteroscedasticity and endogeneity problems.

Results Although the Wald test results propose the difference in preferences between tobacco spending and non-spending households in Vietnam, once controlling for household characteristics, the results from GMM 3SLS method show that the differences are insignificant. Generally, the crowding-out effect of tobacco spending in Vietnamese households is modest because of the small share of tobacco in the total household expenditure. An increase in tobacco expenditure only leads to a fall in the budget shares of education. The crowding-out effect, however, mainly appears in the case of low-income households.

Conclusions The reduction in education caused by tobacco consumption, particularly in low-income households, may extend inequality and thus prevent the socioeconomic development in Vietnam in the long term. Additionally, the tiny share of tobacco in household expenditure reveals that the price of tobacco products in Vietnam is extremely low, leading to high proportion of tobacco smokers. Government, therefore, should continuously increase the tobacco tax so that it could restrict the tobacco affordability.

INTRODUCTION

The correlation between tobacco use and development issues such as poverty and health problems are broadly recognised around the world.^{1 2} Without any intervention, tobacco use may cause one-third of deaths from vascular disease, half of the cancers and 60% of chronic respiratory diseases.³ Worldwide, more than 7 million deaths are related to tobacco use every year and two-thirds of smokers live in developing countries.⁴

In fact, there are evidence that the burden created by tobacco use for developing countries is more severe than for developed countries. Besides the negative effect on health, expenditure on tobacco also creates a reduction in expenditure on basic goods such as food, education, housing, durable

goods, energy and so on.^{5 6} In addition, the opportunity cost of tobacco spending is more considerable for households with a constrained budget. As a result, smokers and their family members including women and children suffer the consequences of tobacco use.

The reduction of expenditure on basic goods due to tobacco spending is known as the crowding-out effect which leads to the deterioration in living standard and exacerbates effects of poverty.⁷ Literature on tobacco expenditure confirms the crowding-out effect of tobacco on household expenditure using both descriptive statistics and econometric methods.^{5 6 8}

To establish the causal crowding-out effect of tobacco spending in India, John⁵ introduced an instrumental variable (IV) technique which has then been adopted to examine the crowding-out effect in a series of developing countries such as Taiwan, South Africa, Cambodia, Zambia, Turkey and Bangladesh. More recently, the technique has been codified into a toolkit—‘Using household Expenditure Surveys for Research in the Economics of Tobacco Control’.⁹ In this study, similar to previous studies, we applied the method introduced in the Toolkit to examine the crowding-out effect in the case of Vietnam.

According to Global Adult Tobacco Survey conducted in Vietnam in 2015, Vietnam ranked among the top 15 countries in the world for tobacco use with 15.6 million smokers. Nearly a half of male adults in Vietnam are currently smoking tobacco. Besides, the number of non-smokers who are exposed to secondhand smoking at workplace and home are 5.9 million and 28.5 million people, respectively.¹⁰

The remarkable development record of Vietnam in recent years unfortunately increased the availability and affordability of tobacco products. From 2005 to 2016, while nominal income per capital increased by 4.7 times, the retail price of the most popular Vietnamese tobacco products increased only by 2.2 times. In the same period, the relative income price measured by the percentage of income required to purchase 100 packs of cigarettes in Vietnam also decreases from 9% to only 4.3%.¹¹

Additionally, the tobacco tax in Vietnam remains as one of the lowest rates in the world at 41.6% of the retail price. After controlling for purchasing power parity, cigarette prices in Vietnam in 2015 were still ranked second lowest among 20 countries in the Western Pacific Region at only US\$2.18 per pack.¹¹ In short, the affordability of tobacco products in Vietnam has constantly increased due to the inadequate tax policies on tobacco and the high



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income growth which subdues the increase in price of tobacco products.

In 2017, the total revenue of Vietnam Tobacco Corporation (Vinataba) reached over US\$1 billion. However, the economic and health consequences of tobacco use are more considerable. Each year, there are more than 40 000 deaths from tobacco-related diseases such as cancers, cardiovascular disease and chronic respiratory diseases. Without any policy intervention, the number of deaths caused by tobacco use is estimated to be as high as 70 000 in 2030. The economic cost caused by tobacco use in 2011 was estimated to be US\$1173.2 million, equivalent to 0.97% of the gross domestic product (GDP).¹² It could be said that the contribution of tobacco industry is insufficient to neutralise the health damages and economic loss of tobacco use.

Additionally, the estimated expenditure on tobacco products in 2015 for Vietnam was approximately US\$1400 million which is approximately equivalent to 0.72% of GDP (calculated by authors using data from Tobacco Taxes in Vietnam: Questions and Answer, 2018). In the meantime, the government expenditure on health in the same year is 5.62% of GDP (Source: World Health Organization Global Health Expenditure database). It is reasonable to expect that similar to other developing countries, tobacco consumption in Vietnam may also have the crowding effect on other household expenditure items. However, to our knowledge, there has been no research measuring the crowding-out effect of tobacco on household expenditure in Vietnam.

We cover nine expenditure categories in our analysis (ie, food, health, education, clothes, durable goods, housing, entertainment, electricity and energy, alcohol and tobacco) using the data from the latest Vietnam Household Living Standard Survey (VHLSS) in 2016. Applying the IV approach, we found that increases in tobacco spending lead to reduction in the share of expenditure on health, education and housing but a rise in the share of food, alcohol and energy and electricity.

The crowding-out effects appear in Vietnam mainly on education. This result is similar to those in Turkey, India and Bangladesh.^{5 6 13} In terms of expenditure on food, comparing the crowding-out effect of tobacco in Turkey between 2007 and 2011, San and Chaloupka¹³ showed that tobacco spending reduced expenditure on food in 2007; however, it had no effect in 2011. In Vietnam, we found that tobacco spending also had no effect on household expenditure on food in 2016. By contrast, tobacco spending also positively impacts expenditure shares on alcohol, durable goods as well as energy and electricity. Additionally, while the crowding-out effect appears mainly in the case of low-income households in Vietnam, there is no effect on middle-income and high-income households.

Our paper is structured as follows. In the following section, we introduce the data and some descriptive statistics on the differences in expenditure patterns between tobacco spending and non-spending households. The next section presents econometric specification and results. We discuss the implications in the last section.

DATA AND DESCRIPTIVE STATISTICS

This study uses data from the VHLSS which has been carried out biannually since 2000 by the General Statistics Office of Vietnam with technical support from the World Bank. The VHLSS is national representative sample for all the 63 Vietnamese provinces and each wave sample comprises approximately 9000 households. The aim of the data is to measure the living standards in the entire country; therefore, it contains a wide range of information of households such as demographic characteristics

Table 1 Summary statistics for averages and budget shares of tobacco expenditure

	2016		
	Average annual expenditure on tobacco ('000VND)	Share of tobacco expenditure (%)	Sample size
All incomes	1878.906	1.92	4100
Low income	1170.729	2.19	1053
Middle income	1873.722	2.02	1756
High income	2463.579	1.56	1291

*US\$1 = 22.700 VND.

of household members, household income, expenditure, asset, housing and facilities. In our analysis, we focus on the latest data, the VHLSS 2016.

As the nationally representative and official household consumption survey in Vietnam, VHLSS collects household expenditures of nearly 200 food and non-food items. Based on the detailed data of expenditure in VHLSS, we construct nine subgroups including food, health, education, clothes, durable goods, housing, entertainment, electricity and energy, alcohol and tobacco following John.⁵ Depending on the purpose of expenditures, expenditures on non-food items are asked over last 30 days before the survey or over last 12 months. In the case of food, both information of monthly expenditure and expenditure on holidays are collected. While monthly food expenditures are asked over last 30 days before the survey, expenditures on holidays are over last 12 months. In this study, all consumption expenditures are converted in average yearly values.

A dummy variable taking values '1' for positive tobacco spending and '0' for no tobacco spending was constructed to make a comparative analysis between the expenditures of tobacco spending households and non-spending households. The number of tobacco spending households in 2016 is 4100 (corresponding to 44.86% of the sample). Table 1 presents the average annual expenditure on tobacco by income levels and the corresponding budget shares. Generally speaking, the expenditure on tobacco has increased in all income levels and the average expenditure on tobacco of all tobacco spending household has approximately remained at US\$85. It is worth noting that the share of tobacco spending in total household expenditure is really modest, accounting for only 1.92% on average. It could be explained by the fact that prices of tobacco products in Vietnam are cheap and have become even more affordable.

Table 2 presents the average annual share of household expenditures on each commodity for non-spending and tobacco spending households. Moreover, differences between the expenditures of two household groups and results of Student's t-test for the differences are also reported. As shown in table 2, the average annual budget shares of food, health and housing are higher among non-spending households than tobacco spending households. By contrast, the tobacco spending households consume more alcohol and energy and electricity. There is no significant difference in the budget share of education entertainment and durable goods.

Generally speaking, table 2 suggests that tobacco spending may have an effect on household expenditure. On the one hand, because of the budget constraint, tobacco spending households may not spend on some necessity goods as much as non-spending households. On the other hand, the difference in taste or preferences may drive them to expense more on luxury goods such as alcohol and energy and electricity. A drawback of t-test is that it

Table 2 Average shares of commodities and t statistics of the differences between non-spending and tobacco spending households

Commodities	Non-spenders	Spenders	Difference	t-stat†
Food	0.5907	0.5851	0.0057	1.88*
Health	0.0548	0.0397	0.015	8.71***
Education	0.0353	0.0339	0.0014	1.10
Housing	0.0256	0.0181	0.0074	4.42***
Entertainment	0.0408	0.0417	-0.0009	-1.16
Clothing	0.032	0.0317	0.0004	0.82
Alcohol	0.0047	0.0087	-0.004	-16.82***
Energy and Electricity	0.0876	0.0896	-0.002	-1.79*
Durable goods	0.0409	0.0435	-0.0026	-1.24
Other	0.0875	0.0894	-0.0019	-1.25
Sample size	4100	5291		

*, ** and *** show significance levels at 10%, 5% and 1%, respectively.

†Null hypothesis of the Student t statistics for each goods is H_0 : mean (non-spenders) – mean (spenders)=0.

does not control for factors that may influence intrahousehold resource allocation decisions such as household demographics and its socioeconomic characteristics. To examine the differences between the expenditures of two household groups, we need a more robust econometric analysis which can conceptualise the preferences of household groups and measure the crowding-out effect of tobacco.

THEORETICAL BACKGROUND

Given a vector of characteristics \mathbf{a} and the prices of all goods $\{p_1, \dots, p_n\}$, a household would maximise its utility subject to a budget constraint,

$$\text{Max} U = U(q_1, \dots, q_n, a) \text{ s.t. } \sum_{i=1}^n p_i q_i = Y$$

where p_i denotes its consumption of i th good and Y denotes total expenditure of the household. The solution will be a set of unconditional Marshallian demand curves for each of the goods:

If the demand for one of the goods, say tobacco, is predetermined, the household now has to maximise its utility subject to the total expenditure after deducting expenditure on tobacco. Following Pollak (1969), let tobacco be the n th good, the first $n - 1$ goods are available in the market for the price $\{p_1, \dots, p_{n-1}\}$ and the total expenditure on these $n - 1$ goods are given by $M = Y - p_n q_n$ (where q_n denotes a household's demand for tobacco). Now the utility maximisation problem for the household will be:

$$\text{Max} U = U(q_1, \dots, q_n, a) \text{ s.t. } \sum_{i=1}^{n-1} p_i q_i = M$$

The solution for this problem gives conditional demand functions:

ECONOMETRIC SPECIFICATION AND RESULTS

Before measuring the crowding-out effect of tobacco spending, we need to verify if the difference in budget shares between the two household groups is due to either corner solution or sheer abstention. More specifically, corner solution means that given their income, non-spending households cannot consume tobacco products because of unaffordable prices. In that case, if the prices of tobacco products decrease to a certain extent, they may spend a part of their resources on tobacco. The other explanation of zero tobacco expenditure is that non-spending households do not want to smoke even if they have sufficient resources to pay for it. In other words, sheer abstention means that non-spending and tobacco spending households have different preferences.

In order to determine that the zero expenditure on tobacco is due to either corner solution or abstention, we estimate the Engel curve for nine goods of interest using the Quadratic Almost Ideal Demand Systems (QUAIDS) because of the lack of price information for all goods of interest

$$w_i = (\alpha_{1i} + \alpha_{2i}d + \alpha_{3i}q + \delta'_i a) + (\beta_{1i} + \beta_{2i}d) \ln M + (\gamma_{1i} + \gamma_{2i}d) (\ln M)^2 \quad (1)$$

where w_i stands for the budget shares of i commodity group; d is the dummy variable that takes '1' for tobacco spending households and '0' otherwise; q is the total spending on tobacco; a is the vector of household characteristics including household size, average education and years of education received by the most educated members in the household and dummy variables of year and M is total expenditures minus tobacco spending.

The potential endogeneity problem of M and q has been reported in previous studies.^{5,13} In order to test the null hypothesis H_0 : Regressors are exogenous, we carry out the Durbin-Wu-Hausman test. If there is a relationship between two endogenous variables, we need to apply IV method to obtain consistent estimators. Following the Toolkit,⁹ total expenditure is used as an IV for the total expenditures minus tobacco spending M , and the ratio of adult male to adult female is used as an IV for tobacco spending.

Additionally, we have to face with the contemporaneous correlation, that is, the share of each good may be affected by the share of other goods. In order to simultaneously deal with both endogeneity and contemporaneous correlation problems, we need to use the Three-stage Least Square method to estimate the Engle curve. Last but not least, we need to check if the errors are heteroscedastic. The presence of heteroscedasticity in the IV regression can lead to inconsistent SEs. In this case, we use GMM 3SLS estimation to analyse the crowding-out effect of tobacco spending. The statistical tests report that both endogeneity and heteroscedasticity problems are present. The null hypothesis to test whether or not the preferences of tobacco spending and non-spending households are different is as follows:

$$H_0: \alpha_{2i} = \beta_{2i} = \gamma_{2i} = 0 \quad (2)$$

If H_0 is not rejected, the preferences of both household groups are similar and we can conclude that non-spending households currently do not expense on tobacco because of the relatively high price of tobacco products in comparison with the household income. By contrast, if H_0 is rejected, the preferences are significantly different. That is, tobacco consumption only reduces the household resource on allocation on other goods (excluding alcohol) but not create any difference in preference for the expenditure pattern of the two household groups. In other words, tobacco consumption only creates an income effect and but not substitution effect.

Table 3 shows that the χ^2 statistics for goods of interest generally exceed the critical value at the significance level of 10%, except for the case of alcohol. Therefore, we can use equation (1) to analyse the crowding-out effect. The results for the quadratic conditional Engel curve using 3SLS are presented in table 4. An increase in the expenditure on tobacco leads to a fall in the budget shares of education in Vietnam while it leads to a rise in durable goods, alcohol and energy and electricity. The coefficient of q is insignificant in the cases of food, health, housing, clothing and entertainment. Although the results of Wald test suggest differences in expenditure preferences between tobacco spending and non-spending households, after controlling for household characteristics and using GMM 3SLS method to deal with endogeneity and heteroscedasticity, we cannot see the difference in preference of the two household groups.

Table 3 Wald test† results for the equation (2)

Commodities	χ^2 statistics
Food	8.09**
Health	14.01***
Education	10.31**
Housing	4.12
Entertainment	4.02
Clothing	2.94
Alcohol	33.21***
Energy and Electricity	12.5***
Durable goods	19.95***

*, ** and *** show significance levels at 10%, 5% and 1%, respectively.

†A parametric statistical test for the joint significance of parameters.

Next, we consider separately the crowding-out effect of tobacco through income levels. The result of the quadratic conditional Engel curve in low-income, middle-income and high-income households is shown in table 5. It is clearly seen that the budget shares of low-income and high-income households are not significantly influenced by tobacco spending. The crowding effect mainly appears to low-income households.

Finally, we need to check the validity of IVs. To achieve reliable estimates of crowding-out effect, valid IVs must satisfy the two inclusion and exclusion restrictions. On the one hand, an IV must be significantly correlated with tobacco spending after controlling for other exogenous variables. On the other hand, it must be uncorrelated with the residual of the equation (2). The Anderson LM statistic and Cragg-Donald Wald F statistic report that the IVs measured by the total household expenditure and the ratio of adult male to adult female are valid. Unfortunately, we cannot have the Sagan statistic of the overidentification test because the equation is exactly identified.

DISCUSSION AND CONCLUSION

This study analyses the crowding-out effect of tobacco spending on household resource allocation in Vietnam using data from VHLSS 2016. In this paper, GMM 3SLS estimation method is used to simultaneously deal with endogeneity problem and heteroscedasticity. However, we would like to acknowledge that it is difficult to find perfect instruments which are completely

uncorrelated with the error terms. San and Chaloupka¹³ discussed that the ratio of adult male to adult female which we used as our instrument may be associated with other variables of household characteristics such as family size. Besides, in the absence of Sagan statistics, the quality of IVs is not perfectly verified.

Similar to previous studies on crowding-out effect of tobacco spending in developing countries, we show that tobacco spending decreases the share of household expenditure on education in Vietnam. On the one hand, the cutback in education may lead to long-term negative impacts on living standards of households in Vietnam in general as well as child development in particular. Finally, it may prevent these households from escaping poverty and increase inequality in society. On the other hand, our result shows that the crowding-out effect mainly appears only in the case of low-income households but it has no effect on the budget share of middle-income and high-income households in Vietnam.

It could be explained as a result of the affordability of tobacco products in Vietnam. In other words, the low price of tobacco products facilitates tobacco expenditure of middle-income and high-income households in Vietnam and it only creates impact only on the vulnerable households. This finding suggests an important role that tax policy on tobacco products can play. Any increase in the price of tobacco products that lowers tobacco demand will help to raise the overall household welfare through reducing the crowding-out effect of tobacco spending.

Despite the evidence of possible effectiveness tobacco tax in curbing the epidemic in the literature, the relatively small increases in tobacco taxes in Vietnam did not produce much impact as compared with other countries. Evidence suggests that the impact of tax increases in Vietnam only had limited short-term impact. Tobacco spending reduced only in the year of tax adjustment (eg, in 2008 and 2016) but increased in the following years. In fact, there has been only change in tax revenue in the first years of tax adjustment. In this context, our paper provides an evidence to encourage government to continuously increase the tobacco tax so that it could restrict the tobacco affordability in Vietnam.

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Table 4 The quadratic conditional Engel curve

Independent variables	Food	Health	Education	Housing	Clothing	Entertainment	Durable goods	Alcohol	Energy and Electricity
Dummy variable for tobacco spending (d)	-1.1126	-0.1049	-0.2221	0.2825	-0.0219	-0.2067	1.7532	0.0576	-0.1203
	-0.7395	-0.4335	-1.1768	-0.3019	-0.0837	-0.2295	-1.3449	-0.2041	-0.5409
Total amount of tobacco spending (q)	0.0293	-0.0234	-0.0710***	-0.0164	-0.001	0.0106	0.0450**	0.0129***	0.0333**
	-0.0257	-0.0148	-0.0253	-0.0136	-0.004	-0.0071	-0.0227	-0.0044	-0.0139
Log of total expenditure (lnM)	-0.1447**	0.1554***	0.0127	-0.0433	0.0043	0.0159	-0.2039**	-0.0066	-0.0182
	-0.0734	-0.0343	-0.0452	-0.061	-0.0088	(0.0169))	-0.0812	-0.0067	-0.0247
Square of (log) total expenditure-(lnM) ²	0.0029	-0.0064***	0.0001	0.0034	-0.0004	-0.0004	0.0106***	0.0002	-0.0006
	-0.0032	-0.0014	-0.0019	-0.0027	-0.0004	-0.0007	-0.0036	-0.0003	-0.001
Interaction term (d × lnM)	0.207	-0.0063	-0.018	-0.056	0.0043	0.0437	-0.2735	0.0025	0.0513
	-0.135	-0.0778	-0.2085	-0.0958	-0.0154	0.0413)	-0.2398	-0.036	-0.0958
Interaction term (d × lnM) ²	-0.01	0.0016	0.0042	0.0029	-0.0002	-0.0024	0.0098**	-0.0008	-0.004
	-0.0064	-0.0036	-0.0093	-0.0045	-0.0008	-0.0019	-0.0107	-0.0016	-0.0043
Sample size	9391	9391	9391	9391	9391	9391	9391	9391	9391

The study focuses on the effect of tobacco expenditure on spending for other goods, so the coefficients of household characteristics are not reported.

All commodity groups are considered as a dependent variable.

*, ** and *** show significance levels at 10%, 5% and 1%, respectively.

Table 5 The quadratic conditional Engel curve by income levels

	Food	Health	Education	Housing	Clothing	Entertainment	Durable goods	Alcohol	Energy and Electricity
Low income									
Dummy variable for tobacco spending (d)	0.8668	-0.9381	-0.7905	-0.9548	-0.2964	-0.0218	1.8458	0.0759	0.1227
	-2.6588	-1.1437	-1.6237	-1.4281	-0.1875	-0.2572	-2.5804	-0.2955	-1.1686
Total amount of tobacco spending (q)	0.0252	0.0574	-0.0928**	-0.0406	0.0024	0.0087	0.0298	0.0164**	0.0689**
	-0.0554	-0.0383	-0.0388	-0.0311	-0.0096	-0.0122	-0.0329	-0.0078	-0.0327
Sample size	2.656	2.656	2.656	2.656	2.656	2.656	2.656	2.656	2.656
Middle income									
Dummy variable for tobacco spending (d)	6.366	-0.3487	-7.683	0.1043	-0.7711	0.3725	4.2255	1.2663	2.4327
	-7.3075	-2.2694	-11.2654	-3.0513	-1.2889	-0.9297	-9.1312	-1.3739	-3.0387
Total amount of tobacco spending (q)	0.111	-0.0113	-0.2212	-0.009	-0.0226	0.013	0.1785	0.027	0.0533
	-0.1386	-0.0476	-0.2286	-0.0375	-0.0261	-0.0202	-0.1907	-0.0278	-0.0615
Sample size	3681	3681	3681	3681	3681	3681	3681	3681	3681
High income									
Dummy variable for tobacco spending (d)	-1.8405	0.106	-0.1495	-1.3928	-0.1285	0.0643	4.4280*	-0.0137	-0.2655
	-2.1203	-2.2976	-1.1693	-1.5137	-0.22264	-0.6638	-2.6259	-0.2489	-0.5523
Total amount of tobacco spending (q)	0.0337	-0.044	-0.0065	-0.0094	0.0024	0.0107	-0.0195	0.0049	0.0079
	-0.0314	-0.0234	-0.0187	-0.0169	-0.0049	-0.0106	-0.0248	-0.0031	-0.0113
Sample size	2794	2794	2794	2794	2794	2794	2794	2794	2794

*, ** and *** show significance levels at 10%, 5% and 1%, respectively.

What this paper adds

- Our study demonstrates the crowding-out effect of tobacco consumption on household expenditure on education in Vietnam. The effect mainly appears in the case of low-income households. This effect may lead to long-term negative impacts on living standards of households as well as increase inequality in the society.
- The statistics on tobacco expenditure confirm the affordability of tobacco products. Low price of tobacco products facilitates tobacco spending in Vietnamese households and, therefore, may negatively impact non-monetary welfare of households.
- The findings in this paper support the notion that tax increases in Vietnam only had limited short-term impact leading to a reduction of tobacco spending in the year of tax adjustment. It is necessary for Vietnamese government to continuously increase the tobacco tax rate so that it could restrict the tobacco affordability.

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Contributors AN is responsible for the entire project, designed the study, reviewed an earlier draft and finalised the manuscript. N-MN is responsible for empirical analysis and wrote an earlier draft of the manuscript.

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