Crowding-out Effect of Tobacco Consumption in Bosnia and Herzegovina

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Acknowledgments

Acronyms

ASBiH: Agency for Statistics of Bosnia and Herzegovina

BiH: Bosnia and Herzegovina

CPI: Consumer price index

COICOP: Classification of Individual Consumption by Purpose

GDP: Gross domestic product

HBS: Household Budget Survey

IMF: International Monetary Fund

IVGMM: Instrumental variables generalized method of moments

JHU: Johns Hopkins University

UIC: University of Illinois Chicago

WARP: Weighted average retail price

3SLS: Three-stage least squares

Abstract

Background

In Bosnia and Herzegovina, one of the highest smoking prevalence rates in Europe translates into a notable share of household budgets devoted to tobacco products. Among low-income groups, this share can exceed nine percent of total spending, diverting resources from basic needs such as food, health, and education. Such patterns raise concerns about the role of tobacco consumption in reinforcing poverty and limiting investment in human capital. Understanding the crowding-out effect of tobacco consumption is, therefore, crucial for designing policies that address both public health and socioeconomic welfare.

Methodology

This study applies consumption theory, using a system of quadratic Engel curves on household budget survey (HBS) data for 2011, 2015, 2021, and 2022, to estimate the crowding-out effect of tobacco spending on other household consumption categories. Tobacco demand is treated as predetermined, with the residual budget—total expenditure minus tobacco spending—allocated across non-tobacco goods. Household characteristics and a smoking status indicator capture preference heterogeneity between smokers and non-smokers. To address simultaneity and endogeneity in budget allocation, the analysis employs a three-stage least squares (3SLS) approach with instrumental variables, controlling for heteroskedasticity through 500 bootstrapped replications and testing.

Results

Analysis of the 2011, 2015, 2021, and 2022 HBS data shows that tobacco-consuming households in Bosnia and Herzegovina consistently allocate a higher share of their budgets to alcohol, restaurants, bars, entertainment, and clothing, while spending proportionally less on food, housing, health,

education, and other essential categories. The results suggest that tobacco is unlikely to be part of the utility function for households that report no tobacco consumption. Overall, tobacco spending is found to reduce the budget share allocated to key components of household welfare—most notably food, housing, health, and education—while increasing the share directed towards alcohol, non-alcoholic beverages, and dining out, with these effects being particularly pronounced among low-income households.

Conclusions

The findings demonstrate that tobacco expenditure in Bosnia and Herzegovina crowds out spending on essential goods and services, thereby potentially undermining household well-being and long-term human capital accumulation. These adverse effects are most pronounced among low-income households, which also bear the highest relative tobacco burden. Conversely, tobacco spending is associated with increased allocation to alcohol, nonalcoholic beverages, and restaurant dining, reflecting a shift towards consumption that is less welfare-enhancing. The results highlight the need for comprehensive tobacco control policies that go beyond taxation alone, incorporating targeted cessation support and public health interventions, especially for low-income groups, to free household resources for more productive uses and improve overall welfare.

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Introduction

In recent years, Bosnia and Herzegovina (BiH) has experienced a notable increase in cigarette affordability, primarily as a result of rising real gross domestic product (GDP) per capita and inflation as measured through the consumer price index (CPI), which were not followed by a proportional increase in tobacco prices. According to the International Monetary Fund (IMF), the average overall inflation rate in the country was 3.9 percent. In contrast, the average annual GDP per capita growth rate (in national currency, constant prices) reached two percent over the past four years (International Monetary Fund, 2024). When viewed cumulatively, between 2020 and 2023, consumer prices increased by 22 percent, and real GDP rose by 10.5 percent, while the population has been declining (Word Bank, n.d.). During the same period, the weighted average retail price (WARP) of cigarettes increased by only 12 percent (Indirect Taxation Authority, 2024).

Given the relatively high estimated income elasticity of demand for cigarettes in BiH, calculated at 0.81 (Gligorić et al., 2023), it can be expected that a 10-percent increase in income would result in an 8.1-percent increase in cigarette consumption. This relationship suggests that rising income levels can significantly contribute to the increased affordability of tobacco products, potentially encouraging higher consumption, particularly among lower-income groups.

Table 1. Households at risk of poverty %

Year	BiH	Republic of Srpska	Federation of Bosnia and Herzegovina
2011	7.7	7.3	8.0
2015	8.4	9.5	7.5
2021/2022	8.6	8.4	8.7

Source: Agency for Statistics of Bosnia and Herzegovina (2025a).

In Bosnia and Herzegovina, 8.6 percent of households were at risk of poverty in 2022, with a slightly lower rate in the Republic of Srpska (8.4 percent) and a marginally higher rate in the Federation of Bosnia and Herzegovina (8.7

percent) (Agency for Statistics of Bosnia and Herzegovina, 2025a). In comparison, 8.4 percent of households were at risk of poverty in 2015, of which 7.5 percent were in the Federation of Bosnia and Herzegovina and 9.5 percent in the Republic of Srpska. In 2011, the overall poverty risk stood at 7.7 percent, with 8.0 percent of households in the Federation of Bosnia and Herzegovina and 7.3 percent in the Republic of Srpska.

A growing body of international research has investigated the so-called crowding-out effect, which refers to the reallocation of limited household resources from essential goods and services, such as food, health, and education, towards tobacco consumption. This issue is particularly relevant in low- and middle-income countries (LMICs), where household budgets are often constrained, and expenditure on tobacco can represent a substantial burden.

Among the first studies on the topic, Efroymson et al. (2001) showed that poor households in Bangladesh often spend more on tobacco than on essential needs, such as clothing, health care, and education. These findings were further confirmed by John (2008) in India, who identified significant reductions in expenditures on milk, education, and clean fuels in smoking households. Additionally, tobacco spending was found to have negative effects on per capita nutrition intake. In rural China, Wang et al. (2006) demonstrated that tobacco spending negatively affects investments in education, farming productivity, and financial security.

Expanding the scope to a global level, Do and Bautista (2015) used data from 40 LMICs and found that daily tobacco use reduces household spending on education by eight percent, and on health care by 5.5 percent. These findings are echoed in Cambodia, where John et al. (2011) demonstrated that tobacco spending significantly lowers expenditures on food, clothing, and education, with the effects being especially pronounced among low- and middle-income households. Other studies from comparable countries found evidence supporting our hypothesis that tobacco consumption shifts the consumption

patterns of households, especially for low-income households, as will be discussed in the following sections.

San and Chaloupka (2015) examined the impact of tobacco expenditures on Turkish households using 2007 and 2011 data from Turkish Household Budget Surveys. Households with smokers spent eight percent of their budget on tobacco, reducing spending on essentials like food, housing, and utilities. For example, non-smoking households spent nine percent more on food and housing than smoking households. Tobacco spending also increased allocations for transportation and entertainment. The implementation of tobacco control policies in Turkey, including substantial tax increases (from 39 percent to 79 percent of the retail price) and comprehensive smoking bans, resulted in a notable reduction in household tobacco expenditures. Despite these policy-induced decreases, the overall patterns of spending misallocation persisted, suggesting that structural consumption behaviors remained largely unchanged even in the face of regulatory interventions. The findings highlight the economic burden of tobacco on households, especially lower-income groups, and call for further research on policy effectiveness.

Mugosa et al. (2023) found that tobacco consumption significantly reduces household spending on key welfare-related categories, particularly education, and health, with the strongest effect on poorer households. The findings suggest that smokers' households allocate less money to human capital investments, which can negatively affect long-term development outcomes. In contrast, non-smoking households tend to spend more on education, food, and housing. The paper emphasizes the intergenerational impact of these spending patterns, as reduced investment in children's health and education may reinforce cycles of poverty. These results highlight the need for stronger tobacco control policies in Montenegro to protect vulnerable populations and improve overall household welfare.

Vladisavljević et al. (2023) show that tobacco consumption in Serbia leads to significant reductions in spending on essential categories such as food, education, clothing, recreation, and culture, especially among low-income

households. At the same time, spending on tobacco is associated with increased expenditures on complementary, less-productive items like alcohol and services in bars and restaurants. These patterns indicate that tobacco use distorts household budgets, limiting investments in long-term well-being and human capital. Vladisavljević et al. emphasize that due to the inelastic demand for tobacco, price changes alone may not significantly reduce consumption, and quitting smoking is the only way for households to free up resources. Based on these findings, they call for stronger tobacco control policies and better enforcement in Serbia to protect vulnerable households and promote healthier and more productive spending.

In light of these findings and overall trends, the current research aims to examine the crowding-out effect of tobacco consumption in BiH by analyzing intra-household resource allocation patterns. To achieve this, the study will utilize data from the Household Budget Survey (HBS) for the years 2011, 2015, 2021, and 2022. HBS provides comprehensive data on household consumption expenditures, with particular emphasis on the social and economic conditions under which households live. These data allow for both qualitative and quantitative analysis of household behavior and consumption trends over time, enabling a thorough examination of the impact of tobacco spending on other categories of household expenditure.

The contribution of this research lies in providing empirical evidence on how tobacco consumption affects the structure of household spending in Bosnia and Herzegovina, highlighting potential trade-offs between tobacco and essential goods such as food, education, and health care. By identifying the extent to which tobacco expenditure crowds out welfare-enhancing consumption, the findings can serve as valuable evidence for policy makers in designing targeted fiscal and public health measures. Such insights can support the development of more effective taxation policies and social programs aimed at reducing tobacco consumption and improving household welfare.

Data and Methodology

Methodology

The theoretical baseline for this study is consumption theory, specifically Engel curves. According to Engel's Law, the household maximizes its total utility, which is a function of n commodities, including tobacco. We assume that tobacco demand (q_t) is predetermined at the level $q_t = \bar{q}_t$ (Pollak, 1969).

The utility function is given as:

$$MaxU = f(q_1, q_2, \dots, q_{n-1}, \bar{q}_t; a) \qquad (1),$$

where *MaxU* represents maximum total utility, q_1-q_{n-1} represents different types of commodities, excluding tobacco, and the set of household characteristics *(a)*. The budget constraint, after subtracting the tobacco expenditure, is defined as:

$$R = \sum_{i=1}^{n-1} p_i q_i \qquad (2),$$

where R represents the household's residual budget available for different commodities, after subtracting expenditure on tobacco:

$$R = I - p_t \bar{q}_t \qquad (3),$$

where *I* represents household total income, and p_t represents the tobacco price.

The demand for other commodities is modeled as conditionally dependent on the level of tobacco consumption *(q_t)*, the price vector of non-tobacco goods *(p_1, p_2, …, p_{n-1})*, the household's residual budget *(R)* after tobacco expenditure, and a vector of household-specific characteristics. In this way, we estimate the following model:

$$q_{ij} = \alpha_i + \beta_{1i}d_j + \beta_{2i}exptob + (\gamma_{1i} + \gamma_{2i}d_j)lnR_j + (\theta_{1i} + \theta_{2i}d_j)(lnR_j)^2 + \delta_i h_j + \varepsilon_{ij}$$

$$(4),$$

where q_{ij} denotes the budget share of commodity i for household j, defined as the ratio of expenditure on commodity i to the household's residual budget Rj:

$$q_{ij} = \frac{p_{ij}q_{ij}}{R_j}, \qquad (5)$$

where:

- pij = price of commodity i for household j, and
- Rj = residual budget (total expenditure minus tobacco expenditure).

Household tobacco consumption is captured by a binary indicator dij, where:

$$d_{ij} = \begin{cases} 1 \ if \ household \ has \ a \ smoker \\ 0 \ otherwise \end{cases} \qquad (6).$$

Tobacco expenditure, *exptob*, is given by:

$$exptob = p_{nt}\overline{q_{nt}} \qquad (7).$$

Finally, household characteristics (such as income, size, or education) are represented by the vector h_j.

The binary variable dj serves as a smoking status indicator that distinguishes between two fundamentally different household types:

1. smoking households (dj = 1): Tobacco is included in their utility function; and
2. non-smoking households (dj = 0): Tobacco is excluded from their utility function.

This specification is crucial for properly interpreting zero tobacco expenditures, as it allows us to differentiate between a corner solution (where the household cannot afford tobacco at current prices/income), and true abstention (where tobacco provides no utility regardless of affordability).

The inclusion of *dj* thus enables the model to:

1. account for preference heterogeneity between household types;
2. correctly identify the economic interpretation of zero consumption observations; and
3. provide unbiased estimates of tobacco demand parameters.

We employ a Wald test to evaluate the joint significance of coefficients associated with the smoking status indicator in Equation (4). The null hypothesis posits:

$$H_0: \beta_{1i} = \gamma_{2i} = \theta_{2i} = 0 \text{ (no preference differences between household types)}$$

Rejection of H_0 implies statistically significant differences in consumption preferences between smoking and non-smoking households, which means distinct utility function structures for households with positive tobacco expenditures (smokers) and zero tobacco expenditures (non-smokers).

Both tobacco expenditures ($tobexp_j$) and total expenditures (R_j) are endogenous due to reverse causality between spending categories, potential omitted variables affecting consumption choices, and reporting errors in expenditure data. The system exhibits inherent contemporaneous correlation because households allocate budgets simultaneously across categories, and spending on one commodity necessarily affects others through budget constraints. And finally, error variances likely vary systematically. In this context, the generalized method of moments three-stage least squares (GMM 3SLS) estimator is the most appropriate technique for estimating the system of Engel curves.

Evidence of heteroskedasticity in the instrumental variables (IV) regression was confirmed using the Pagan-Hall test (Baum et al., 2003; Mugosa et al.,

2023). To address this issue and enhance the robustness of the estimated coefficients, bootstrapped standard errors based on 500 replications were employed. This resampling approach offers a flexible, nonparametric means of correcting for heteroskedasticity and other violations of classical regression assumptions, leading to more reliable inference (Cameron & Trivedi, 2005).

Standard overidentification tests, such as the difference-in-Sargan (C) statistics, depend on the assumption of homoskedasticity to justify their asymptotic chi-squared distribution. However, when heteroskedasticity is present, these assumptions no longer hold, which can compromise the reliability of the test outcomes (Baum et al., 2007). For this reason, the C-statistics are omitted from the results. Instead, the analysis employs bootstrapped standard errors, which are more appropriate for dealing with heteroskedasticity in the error terms.

To determine whether any regressors were endogenous, we conducted the Durbin-Wu-Hausman test using the "ivreg2" command in Stata with the gmm2, and robust option. This test compares estimates obtained through instrumental variables with those from ordinary least squares. A significant result indicates that the tested variable(s) are endogenous—that is, correlated with the regression error term—thereby violating a core assumption of ordinary least squares and justifying the use of instrumental variables for consistent estimation.

For the instrumental variables approach to be valid, the instruments must meet two key conditions. First, the inclusion restriction requires that the instruments be sufficiently correlated with the endogenous regressors. Second, the exclusion restriction demands that the instruments affect the dependent variable only indirectly through the endogenous variables, without a direct effect. To evaluate these assumptions, we applied the Kleibergen-Paap rk LM test to examine the inclusion restriction and the Hansen J statistic to test the exclusion restriction through overidentifying restrictions. In this study, the number of instruments (four) exceeds the number of endogenous regressors (three), enabling these tests.

Finally, we assessed instrument strength using the Kleibergen-Paap rk Wald F statistic. The Kleibergen–Paap rk Wald F statistic is a robust test used to evaluate instrument strength in IV and GMM estimations, accounting for heteroskedasticity and autocorrelation. It assesses whether the instruments provide sufficient explanatory power for the endogenous regressors to ensure reliable identification. For the case of three endogenous regressors and four excluded instruments, Stock and Yogo (2005) provide critical values for this test: 19.93 for a five-percent maximal relative bias, 13.91 for 10 percent, and 11.59 for 15 percent. A Kleibergen–Paap statistic exceeding these thresholds suggests that the instruments are strong enough to mitigate weak instrument bias, while values below these levels indicate potential identification issues.

If analysis of the crowding out is to be complete, a more complex econometric technique is required. This is mainly because the descriptive statistics do not consider key covariates, principally the specific sociodemographic characteristics. To account for these sociodemographic characteristics, we have used the following variables: household size, number of children aged from zero to five years, number of children aged from six to 16 years, share of adults out of total household members, average age of the household, maximum education of the household members (defined as years of education attained by the highest-educated member in the household), average education of the household members (defined as average years of education in the household), and type of residence (rural or urban), and year fixed effects.

In our analysis, the GMM 3SLS estimator failed to converge; therefore, the estimations were conducted using the traditional three-stage least squares (3SLS) approach. The conventional 3SLS estimator combines the instrumental variables (IV) technique with the seemingly unrelated regressions (SUR) framework, making it particularly well-suited for estimating systems of Engel curves. We estimate a system of quadratic Engel curves using the conventional three-stage least squares (3SLS) estimator, drawing on Household Budget Survey (HBS) data for the years 2011, 2015, 2021, and

2022. To address potential endogeneity, the following instruments are employed: smoking intensity (measured by the average number of cigarettes consumed per household per month), smoking prevalence, the share of working adults in the household, the proportion of male household members, total household expenditure, and the male-to-female ratio (Baum et al., 2003; Mugosa et al., 2023; Vladisavljević et al., 2023).

Data and descriptive statistics

This study is based on the Household Budget Survey (HBS) for the years 2011, 2015, 2021, and 2022, which provides comprehensive data on household consumption expenditures, with particular emphasis on the social and economic conditions under which households live.[i] Since the HBS does not include data on household income, total reported expenditures were used as a proxy for income. The sample was then divided into three groups based on household per-capita expenditure: high-income, middle-income, and low-income groups.

Following the Classification of Individual Consumption by Purpose (COICOP)—a framework established by the United Nations Statistics Division—household expenditures in the HBS are categorized into 12 mutually exclusive and exhaustive commodity groups. In this study, we leverage the granularity of HBS data to further disaggregate expenditures within COICOP Group 2 ('Alcoholic Beverages and Tobacco'), isolating tobacco and alcohol spending. We further disaggregated food and non-alcoholic beverages, which allowed for a more detailed classification and an increased number of product groups for analysis. The primary objective is to quantify how tobacco expenditures influence spending across different commodity groups. Variables, their definitions and their sources are presented in Table 2.

Table 2. Data and definitions

Variable	Definition	Source
tobexp	monthly tobacco expenditure	HBS
alcohol	monthly alcohol expenditure	HBS
food	monthly food expenditure	HBS
ready_food	monthly hotels, bars, restaurants and catering expenditure	HBS
clothing	monthly clothing expenditure	HBS
housing	monthly housing expenditure	HBS
goods	monthly durable and non-durable goods expenditure	HBS
education	monthly education expenditure	HBS
health	monthly health expenditure	HBS
transport	monthly transportation expenditure	HBS
entertainment	monthly entertainment expenditure	HBS
staple_food	monthly bread and grains expenditure	HBS
meat	monthly meat expenditure	HBS
fish	monthly fish expenditure	HBS
dairy_eggs	monthly eggs, cheese and milk expenditure	HBS
vegetable	monthly vegetable expenditure	HBS
fruit	monthly fruit expenditure	HBS
beverage	monthly water and non-alcohol beverage expenditure	HBS
alcohol	monthly alcohol expenditure	HBS
other	monthly various food products expenditure	HBS
IV	instrumental variable (smoking intensity, smoking prevalence, share of working adults, share of males out of total household members, total household expenditure, male-to-female ratio)	Authors' calculations and HBS

Table 3 presents the data on average monthly household expenditure and budget shares allocated to tobacco.

Table 3. Average monthly tobacco expenditures (in Bosnia and Herzegovina convertible mark - BAM) and budget shares (2011, 2015, 2021, 2022)

Average monthly expenditures on tobacco and tobacco budget shares								
Year	All households		Low-income		Middle-income		High-income	
	tobacco BAM	budget share on tobacco	tobacco BAM	budget share on tobacco	tobacco BAM	budget share on tobacco	tobacco BAM	budget share on tobacco
2011	81.01	5.20%	66.95	6.50%	78.58	5.10%	94.7	4.10%
2015	85.05	5.70%	60.68	6.40%	81.95	5.80%	106.88	5.20%
2021	123.76	6.00%	96.45	6.20%	130.53	6.30%	139.54	5.50%
2022	109.94	5.90%	87.15	6.20%	98.86	5.60%	140.89	6.00%

Notes: Conditional on households reporting positive tobacco expenditures. All monetary values are deflated to 2010 prices using the consumer price index (CPI).

Source: Authors' calculations based on HBS data CPI obtained from the Agency for Statistics of Bosnia and Herzegovina (2025b).

The tobacco budget share increased steadily throughout the entire period of analysis, a trend observed both in the overall sample and within each income subgroup. Notably, the low-income group consistently exhibited the highest tobacco expenditure share. This finding suggests that reallocating household budgets could potentially yield the greatest benefits for low-income households.

Households belonging to the low-income group that consume tobacco have limited capacity to increase their spending on well-being-related items due to budget constraints. In contrast, middle- and high-income households can allocate more resources towards well-being despite tobacco consumption, relative to their low-income counterparts. Table 4 presents the budget shares allocated to different commodity groups for households that consume tobacco

and those that do not. The table also reports the results of Student's t-tests for the differences in budget shares between the two groups.

Households that do not consume tobacco allocate a larger share of their budget to food, housing, and health, whereas tobacco-consuming households tend to spend more on alcohol, entertainment, and clothing. Statistically significant differences between the two groups were observed for all commodity categories except for meat and goods. These findings suggest that tobacco spending may influence overall household expenditure patterns. (detailed budget shares across various commodity categories for different income groups are reported in Appendix Table, A1). Households in the low-income group that do not consume tobacco allocate a larger portion of their total expenditure to food (33.54 percent) compared to those in the middle-income (32.95 percent) and high-income (29.87 percent) groups (Table A1).

Within the low-income group, households that do not consume tobacco allocate a greater share of their budgets to essential categories such as food, housing, transport, and health (Table A1). In contrast, tobacco-consuming households in this income group tend to spend relatively more on alcohol, entertainment, and clothing (Table A1). In the overall sample, non-tobacco spending households allocate a larger share of their total budget to essential categories such as food, housing, and health, as well as to several subcategories of food including staple food, dairy and eggs, vegetables, and fruit. In contrast, households that consume tobacco spend a relatively greater proportion of their budgets on alcohol, transport, clothing, entertainment, and ready-made food, indicating a shift towards non-essential consumption (Table 4).

Table 4. Budget share and Student's t-tests

All households				
Category	Non-spenders	Spenders	Difference	t-stat
food	32.2%	30.9%	1.32%	7.317***

staple_food	4.8%	4.6%	0.25%	6.060***
meat	7.3%	7.2%	0.02%	0.338
fish	0.8%	0.8%	0.07%	4.239***
dairy_eggs	5.0%	4.6%	0.36%	8.240***
vegetable	3.4%	3.3%	0.15%	3.896***
fruit	2.4%	2.1%	0.23%	8.862***
beverage	1.6%	1.7%	-0.08%	-3.779***
ready_food	1.6%	2.1%	-0.47%	-9.540***
other_food	3.4%	4.1%	-0.69%	-11.385***
housing	22.1%	16.9%	5.25%	32.428***
goods	4.2%	4.3%	-0.05%	-0.709
health	3.7%	2.9%	0.74%	9.064***
education	0.3%	0.5%	-0.13%	-5.168***
transport	8.3%	10.0%	-1.69%	-10.938***
clothing	3.5%	4.2%	-0.71%	-8.668***
entertainment	1.8%	2.0%	-0.22%	-5.500***
tobacco	0.0%	5.6%	-5.62%	-119.933
alcohol	0.8%	1.0%	-0.28%	-10.548***

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

Notes: The null hypothesis is no difference in group means. A significant t-test indicates rejection of the null.

Source: Authors' calculations

Results

The estimation results of the crowding-out effect for BiH are summarized in Table 5, covering both the full sample and stratifications by income group. A comprehensive breakdown of these results is provided in the Appendix (Table A3). The detailed results, presented in the Appendix (Table A2), confirm the validity of all instrumental variables. In BiH, the Wald test indicates statistically significant differences in consumption preferences between households that consume tobacco and those that do not (see Appendix, Table A2 for detailed results). This suggests that tobacco is unlikely to be part of the utility function for households that report no tobacco consumption.

Table 2. Estimation results for the crowding-out effect

	All households	Low income	Middle income	High income
food	-0.0014809***	-0.0001006***	-0.0022691***	-0.0025751**
	(0.0000909)	(0.0007924)	(0.0007258)	(0.0005159)
staple	-0.0001999***	-0.0000554***	-0.0000239***	-0.0000623**
	(0.0000259)	(0.00000952)	(0.00000551)	(0.0000241)
meat	0.0002367***	0.0007225***	0.0003229***	0.000179***
	(0.0000515)	(0.0001393)	(0.0000763)	(0.0000551)
dairy	-0.0005531***	-0.0002323	0.0000619***	-0.0003031***
	(0.0000316)	(0.0002239)	(0.0000415)	(0.0000735)
fish	-0.0001305***	0.0000192	-0.0000243	0.0000265**
	(0.0000117)	(0.0000246)	(0.0000179)	(0.0000116)
vegfruit	-0.000313***	0.00022	-0.0001114**	-0.0001427***
	(0.000029)	(0.0000985)	(0.0000488)	(0.0000353)
beverage	0.0001096***	0.000194***	0.0000641	0.0000291***
	(0.0000245)	(0.0000403)	(0.0000235)	(0.0000151)
clothing	-0.0024133***	-0.0003396***	-0.0000697	-0.0000994*
	(0.0000985)	(0.0001047)	(0.0000762)	(0.0000606)
housing	-0.0032135***	-0.00000321	-0.0028908***	-0.022235***
	(0.0002341)	(0.0002189)	(0.0006167)	(0.0003941)
goods	-0.0002667***	-0.0002745***	-0.0003382***	-0.0003155***
	(0.0000422)	(0.0000808)	(0.0000617)	(0.0000545)
education	-0.000374***	-0.00000293	-0.0000402	0.00000706
	(0.000018)	(0.00000437)	(0.0000249)	(0.000017)
health	-0.0009214***	0.0000192	-0.0001795**	-0.0000459***
	(0.0000451)	(0.0000134)	(0.0000769)	(0.0000131)
transport	0.0037665***	0.0003426**	0.0002486**	0.0000221
	(0.0002462)	(0.0001526)	(0.0001192)	(0.0001188)
entertainment	-0.0009389***	-0.0000172***	-0.00000216***	-0.0000681**
	(0.0000527)	(0.00000659)	(0.00000582)	(0.000031)
alcohol	0.0004068***	0.000039	0.0001088***	0.0000854***
	(0.0000714)	(0.0000541)	(0.0000341)	(0.0000229)
ready	0.0009803***	0.0003802***	0.0003898***	0.0005847***
	(0.0000348)	(0.0000532)	(0.0000455)	(0.0000561)
other	-0.0003365***	-0.0002013***	-0.0000733	0.000173***
	(0.0000358)	(0.000074)	(0.0000512)	(0.0000485)

It is important to emphasize that a positive coefficient does not necessarily indicate an increase in the absolute amount spent on a given commodity. Rather, it signifies that the remaining budget share allocated to that commodity increases. In absolute terms, the expenditure on that commodity may still decline. For example, one of the dependent variables in this analysis is the budget share for alcohol consumption after deducting tobacco spending. A positive coefficient in this context indicates a crowding-in effect— that is, the residual budget share for alcohol increases—but the actual monetary expenditure on alcohol may nonetheless decrease.

The main findings are almost the same for all three-income groups. For the full sample, tobacco expenditure is associated with a reduced budget share allocated to food (including staples, dairy products, fish, and fruits and vegetables), clothing, housing, goods, education, health, entertainment, and other food items. These findings indicate that tobacco spending can negatively affect household members' well-being by limiting the consumption of nutritious foods and constraining the adoption of a healthy lifestyle. Moreover, the reduction in budget share on education and health suggests that tobacco consumption may hinder the accumulation of human capital.

Among low-income households, higher tobacco expenditures are linked to a decrease in the proportion of the household budget devoted to food, clothing, and goods. On the other hand, tobacco consumption is associated with higher expenditure on alcohol, non-alcoholic beverages, and dining in restaurants and bars, which is consistent with previous research findings (Drobes, 2002; Hu, 2005; Mugosa et al., 2023; Reis et al., 2018; Room, 2004; Siahpush et al., 2009; Tauchmann et al., 2013; Vladisavljević et al., 2023; Widome et al., 2015). These effects are particularly pronounced among low-income households and may have especially adverse implications for younger

members. The adoption of unhealthy dietary habits, coupled with reduced investment in education and health, can impede the accumulation of human capital and, consequently, limit potential improvements in future well-being.

Discussion and Conclusion

The findings of this study confirm that tobacco consumption in BiH significantly alters household spending patterns, diverting resources from essential goods and services towards less productive categories. Analysis shows that smoking households allocate smaller budget shares to food (especially staples, dairy, fish, and fruits and vegetables), housing, health, and education, while increasing spending on alcohol, non-alcoholic beverages, restaurants, and entertainment. The effect is particularly severe among low-income households, which spend the largest proportion of their budget on tobacco and thus face the greatest welfare losses.

The negative impact of tobacco spending on clothing, housing, and education confirmed in our results for BiH is consistent with regional evidence. Similar patterns were found in Montenegro, where tobacco expenditure was shown to reduce household spending on essential goods such as cereals, fruits, vegetables, dairy products, clothing, housing and utilities, education, and recreation, while simultaneously increasing outlays on alcohol, bars, restaurants, coffee, and sugary drinks (Mugosa et al., 2023). In Serbia Vladisavljević et al. (2023) found similar reductions in essential categories and increases in alcohol and hospitality services. Furthermore, both BiH and Serbia have high prevalence rates of daily smoking and a substantial share of high-intensity smokers (Vladisavljevic et al., 2023; Gligorić et al., 2023), which amplifies the budgetary pressure on households and leaves little flexibility to absorb price changes without cutting other expenditures. These findings strengthen the conclusion that tobacco consumption consistently diverts resources from essential household needs, which in turn restricts living standards and undermines the accumulation of human capital.

In the context of BiH, where tobacco consumption is shown to displace essential household spending—most notably on food (dairy, vegetables, staple food, and fish), health, and education—policy efforts should address both the affordability and social acceptability of smoking. Implementing excise tax increases that exceed inflation and real GDP growth, accompanied by measures to prevent substitution with cheaper or illicit tobacco products, could reduce consumption while protecting public revenue. To maximize the impact, fiscal policies should be complemented by locally relevant public health campaigns that emphasize the economic and health costs of smoking, tailored to resonate with low-income households where the crowding-out effect is most pronounced. Expanding community-based cessation initiatives, for example, through primary health care centers and nongovernmental organizations, would improve accessibility of quitting support beyond urban areas.

Finally, monitoring and research capacities should be strengthened to track household spending patterns over time, ensuring that tobacco control measures are responsive to socioeconomic disparities and contribute to redirecting resources towards welfare-enhancing goods and services. In addition to fiscal and educational measures, a comprehensive ban on smoking in bars and restaurants, alongside stricter enforcement of existing workplace and public smoking restrictions, is essential to reduce the social acceptability of tobacco use and protect non-smokers (Ngo et al., 2017; Vladisavljević et al., 2023). Such steps have already been recognized domestically, as the Federation of BiH adopted the Law on the Control and Restricted Use of Tobacco, Tobacco Products and Other Smoking Products (Parliament of the Federation of BiH, 2022), while in the Republic of Srpska a draft law has been introduced (National Assembly of the Republic of Srpska, 2025), laying the groundwork for harmonized smoke-free environments across the country.

Limitations

Both tobacco expenditures ($tobexp_j$) and total expenditures (R_j) are endogenous due to reverse causality between spending categories, potential omitted variables affecting consumption choices, and reporting errors in expenditure data. The system exhibits inherent contemporaneous correlation because households allocate budgets simultaneously across categories, and spending on one commodity necessarily affects others through budget constraints. Error variances likely vary systematically.

Despite these limitations, this study contributes to the empirical evidence on the crowding-out effects of tobacco consumption by providing detailed estimates for Bosnia and Herzegovina, based on multiple rounds of nationally representative household data. The results demonstrate that tobacco spending is associated with a reduction in expenditures on essential goods—particularly food, health, and education—highlighting its negative welfare implications. These results support the need for stronger tobacco control and fiscal policies that protect household budgets and improve well-being.

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Appendix

Table A 1. Budget share and Student's t-tests by income group

High-income households				
Category	**Non-spenders**	**Spenders**	**Difference**	**t-stat**
food	29.87%	28.42%	1.44%	4.671***
staple_food	4.08%	3.81%	0.27%	4.908***
meat	6.88%	6.88%	0.00%	-0.011
fish	0.95%	0.90%	0.05%	1.757
dairy_eggs	4.29%	3.89%	0.40%	7.296***
vegetable	2.97%	2.73%	0.24%	4.675***
fruit	2.47%	2.18%	0.29%	6.707***
beverage	1.66%	1.72%	-0.06%	-1.686
clothing	4.20%	4.83%	-0.63%	-4.298***
housing	20.23%	15.50%	4.74%	16.955***
goods	5.17%	5.20%	-0.03%	-0.173
education	0.34%	0.57%	-0.23%	-4.453***
health	4.26%	3.29%	0.97%	5.642***
transport	10.07%	11.86%	-1.79%	-5.643***
entertainment	1.98%	2.33%	-0.34%	-4.537***
alcohol	0.88%	1.21%	-0.33%	-7.512***
ready_food	2.29%	2.83%	-0.54%	-5.388***
other_food	4.01%	4.74%	-0.73%	-5.757***
Middle-income households				
Category	**Non-spenders**	**Spenders**	**Difference**	**t-stat**
food	32.95%	31.47%	1.48%	5.103***
staple_food	4.97%	4.67%	0.30%	4.567***
meat	7.53%	7.62%	-0.09%	-0.772
fish	0.90%	0.76%	0.14%	4.813***
dairy_eggs	5.12%	4.69%	0.43%	6.483***
vegetable	3.32%	3.28%	0.03%	0.586
fruit	2.45%	2.19%	0.26%	5.671***
beverage	1.66%	1.71%	-0.05%	-1.326
clothing	3.41%	4.20%	-0.79%	-5.781***

housing	21.82%	16.96%	4.86%	17.794***
goods	4.07%	4.04%	0.04%	0.358
education	0.38%	0.43%	-0.04%	-1.072
health	3.73%	2.73%	1.00%	8.052***
transport	8.27%	9.88%	-1.61%	-6.449***
entertainment	1.69%	1.90%	-0.20%	-2.931**
alcohol	0.80%	1.02%	-0.22%	-4.845***
ready_food	1.55%	1.92%	-0.36%	-4.551***
other_food	3.29%	3.89%	-0.60%	-6.561***

Low-income households

Category	Non-spenders	Spenders	Difference	t-stat
food	33.54%	33.34%	0.20%	0.611
staple_food	5.34%	5.43%	-0.09%	-1.025
meat	7.37%	7.28%	0.09%	0.655
fish	0.67%	0.59%	0.08%	2.928
dairy_eggs	5.43%	5.45%	-0.03%	-0.291
vegetable	3.93%	3.99%	-0.06%	-0.737
fruit	2.25%	2.06%	0.19%	3.940***
beverage	1.59%	1.73%	-0.14%	-3.183***
clothing	3.09%	3.55%	-0.46%	-3.276***
housing	23.98%	18.52%	5.47%	19.174***
goods	3.53%	3.35%	0.18%	1.657
education	0.24%	0.32%	-0.08%	-2.290**
health	3.10%	2.68%	0.42%	3.493***
transport	6.83%	7.75%	-0.92%	-4.214***
entertainment	1.66%	1.67%	-0.01%	-0.238
alcohol	0.65%	0.87%	-0.22%	-4.681***
ready_food	1.04%	1.27%	-0.23%	-3.351***
other_food	3.05%	3.59%	-0.54%	-6.026***

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

Notes: The null hypothesis is no difference in group means. A significant t-test indicates rejection of the null.

Source: Authors' calculations

Table A 2. Test of instrumental variables validity for all households and by income group

All households	Pagan-Hall general test statistic	p value	(Kleibergen-Paap rk LM statistic)	p value	(Kleibergen-Paap rk Wald F statistic	Hansen J statistic (overidentification test of all instruments)	p value	Endogeneity test of endogenous regressors	p value	Wald test	p value
food	27.065	0.0000	1083.470	0.0000	306.012	0.049	0.8243	20561.865	0.0000	1852.52	0.0000
staple food	2081.06	0.0000	1062.433	0.0000	312.734	0.882	0.3475	208.437	0.0000	247.71	0.0000
meat	231.54	0.0000	333.718	0.0000	98.492	0.000	0.9827	59.230	0.0000	102.20	0.0000
dairy	33.885	0.0000	58.125	0.0000	14.513	0.332	0.5643	146.397	0.0000	81.31	0.0000
fish	0.510	0.4750	62.257	0.0000	15.611	0.957	0.3280	30.179	0.0000	12.94	0.0048
other food	141.390	0.0000	62.257	0.0000	15.611	2.352	0.1252	26.718	0.0000	24.08	0.0000
vegetables and fruit	0.000	0.9852	114.016	0.0000	28.933	1.168	0.2798	96.589	0.0000	64.75	0.0000
beverage	661.315	0.0000	114.016	0.0000	28.933	0.056	0.8130	57.431	0.0000	56.12	0.0000
clothing	6.133	0.0133	95.821	0.0000	24.094	0.321	0.5711	76.952	0.0000	62.63	0.0000
housing	6.330	0.0119	114.016	0.0000	28.933	0.488	0.4849	173.658	0.0000	116.93	0.0000
goods	32.841	0.0000	53.347	0.0000	13.374	1.395	0.2376	24.372	0.0000	21.91	0.0001
education	97.081	0.0000	62.257	0.0000	15.611	0.362	0.5474	93.741	0.0000	54.30	0.0000
health	547.748	0.0000	316.328	0.0000	92.507	0.573	0.4491	43.902	0.0000	82.51	0.0000
transport	14.635	0.0001	53.347	0.0000	13.374	0.169	0.6812	315.889	0.0000	55.39	0.0000
entertainment	66.162	0.0000	58.095	0.0000	14.567	0.068	0.7942	11.192	0.0107	10.06	0.0181
alcohol	48.866	0.0000	79.010	0.0000	19.982	1.471	0.2252	95.828	0.0000	174.94	0.0000
ready food	33.498	0.0000	87.122	0.0000	22.063	1.955	0.1620	253.091	0.0000	101.28	0.0000

Source: Authors' calculations

Table A 3. Test of instrumental variables validity for high-income households and by income group

High-income households	Pagan-Hall general test statistic	p value	(Kleibergen-Paap rk LM statistic)	p value	(Kleibergen-Paap rk Wald F statistic	Hansen J statistic (overidentification test of all instruments)	p value	Endogeneity test of endogenous regressors	p value	Wald test	p value
food	0.071	0.7893	44.336	0.0000	11.273	0.645	0.4219	94.865	0.0000	36.95	0.000
staple food	0.207	0.6494	46.991	0.0000	11.915	0.190	0.6633	63.361	0.0000	34.30	0.0000
meat	92.753	0.0000	216.978	0.0000	57.534	0.396	0.5291	11.892	0.0078	17.02	0.0007
dairy	0.065	0.7984	46.730	0.0000	11.885	0.110	0.7407	64.887	0.0000	27.62	0.0000
fish	0.218	0.6403	46.730	0.0000	11.885	0.220	0.6390	32.489	0.0000	18.19	0.0004
other food	90.127	0.0000	216.978	0.0000	57.534	0.025	0.8753	37.401	0.0000	19.04	0.0003
vegetables and fruit	0.954	0.3287	46.991	0.0000	11.915	2.564	0.1093	93.665	0.0000	35.92	0.0000
beverage	166.467	0.0000	46.991	0.0000	11.915	1.137	0.2862	43.022	0.0000	23.37	0.0000
clothing	279.241	0.0000	207.292	0.0000	55.467	0.204	0.6513	22.713	0.0000	15.15	0.0017
housing	1.691	0.1934	46.991	0.0000	11.915	0.033	0.8554	66.879	0.0000	53.15	0.0000
goods	87.875	0.0000	191.020	0.0000	50.742	0.430	0.5119	26.654	0.0000	16.10	0.0011
education	83.018	0.0000	46.991	0.0000	11.915	0.011	0.9171	27.826	0.0000	28.02	0.0000
health	114.439	0.0000	191.020	0.0000	50.742	0.736	0.3909	34.391	0.0000	32.68	0.0000
transport	7.000	0.0082	27.980	0.0000	18.945	1.930	0.1647	199.759	0.0000	25.27	0.0000
entertainment	47.147	0.0000	216.978	0.0000	57.534	1.576	0.2093	10.797	0.0129	6.89	0.0756
alcohol	0.689	0.4064	69.919	0.0000	16.818	0.449	0.5026	287.577	0.0000	74.69	0.0000
ready food	84.072	0.0000	109.92	0.0000	28.415	0.673	0.4122	75.243	0.0000	89.14	0.0000

Source: Authors' calculations

Table A 4. Test of instrumental variables validity for middle-income households and by income group

Middle-income households	Pagan-Hall general test statistic	p value	(Kleibergen-Paap rk LM statistic)	p value	(Kleibergen-Paap rk Wald F statistic	Hansen J statistic (overidentification test of all instruments)	p value	Endogeneity test of endogenous regressors	p value	Wald test	p value
food	0.242	0.6224	31.743	0.0000	18.054	0.562	0.4536	51.149	0.0000	47.42	0.0000
staple food	569.116	0.0000	45.320	0.0000	13.326	0.626	0.4289	7.647	0.0521	0.30	0.9601
meat	112.527	0.0000	63.343	0.0000	19.819	0.008	0.9308	15.564	0.0014	46.06	0.0000
dairy	247.504	0.0000	64.626	0.0000	26.087	1.315	0.2515	8.052	0.0452	12.09	0.0071
fish	1.904	0.1676	57.850	0.0000	27.226	0.846	0.3576	6.665	0.0634	6.96	0.0732
other food	72.266	0.0000	81.200	0.0000	25.044	0.467	0.4942	8.921	0.0304	8.60	0.0350
vegetables and fruit	53.433	0.0000	63.343	0.0000	19.819	0.008	0.9291	8.553	0.0359	6.85	0.0767
beverage	229.762	0.0000	63.343	0.0000	19.819	0.230	0.6318	7.169	0.0667	11.03	0.0116
clothing	209.961	0.0000	63.343	0.0000	19.819	0.144	0.7045	6.620	0.0850	15.55	0.0014
housing	0.792	0.3735	153.863	0.0000	38.811	1.394	0.2378	23.604	0.0000	16.13	0.0011
goods	38.746	0.0000	63.343	0.0000	19.819	0.226	0.6347	28.390	0.0000	24.91	0.0000
education	118.848	0.0000	70.954	0.0000	17.709	0.011	0.9167	11.527	0.0092	14.60	0.0022
health	270.761	0.0000	64.936	0.0000	18.273	1.299	0.2545	11.909	0.0077	4.84	0.1840
transport	93.870	0.0000	80.339	0.0000	20.240	3.925	0.0476	38.969	0.0000	29.83	0.0000
entertainment	1.561	0.2115	28.325	0.0000	42.003	0.047	0.8286	17.921	0.0001	6.19	0.1027
alcohol	50.934	0.0000	63.343	0.0000	19.819	3.994	0.0457	19.214	0.0002	127.86	0.0000
ready food	101.358	0.0000	63.343	0.0000	19.819	2.089	0.1484	20.583	0.0001	44.33	0.0000

Source: Authors' calculations

Table A 5. Test of instrumental variables validity for low-income households and by income group

Low-income households	Pagan-Hall general test statistic	p value	(Kleibergen-Paap rk LM statistic)	p value	(Kleibergen-Paap rk Wald F statistic	Hansen J statistic (overidentification test of all instruments)	p value	Endogeneity test of endogenous regressors	p value	Wald test	p value
food	4.208	0.0452	21.838	0.0000	15.549	1.669	0.1964	57.741	0.000	71.15	0.0000
staple food	13.326	0.0003	31.610	0.0000	8.584	0.183	0.6688	56.922	0.0000	39.31	0.0000
meat	15.594	0.0001	52.827	0.0000	15.335	2.053	0.1519	26.360	0.0000	35.52	0.0000
dairy	98.384	0.0000	52.827	0.0000	15.335	0.930	0.3348	46.401	0.0000	54.29	0.0000
fish	6.746	0.0094	124.728	0.0000	32.088	0.117	0.7521	7.263	0.0640	5.98	0.1125
other food	201.764	0.0000	76738.000	0.0000	21.729	0.970	0.3240	16.188	0.0010	24.67	0.0000
vegetables and fruit	51.119	0.0000	52.792	0.0000	15.318	0.033	0.8559	22.955	0.0000	14.82	0.0020
beverage	258.182	0.0000	52.827	0.0000	15.335	0.611	0.4345	14.035	0.0029	17.87	0.0005
clothing	123.310	0.0000	52.827	0.0000	15.335	0.876	0.3494	17.427	0.0006	19.94	0.0002
housing	236.877	0.0000	52.302	0.0000	15.036	0.024	0.8757	15.293	0.0016	35.10	0.0000
goods	12.259	0.0005	52.827	0.0000	15.335	0.957	0.3279	19.061	0.0003	24.65	0.0000
education	77.930	0.0000	128.279	0.0000	32.125	0.813	0.3672	6.695	0.0823	6.17	0.1034
health	252.304	0.0000	42.451	0.0000	11.469	0.001	0.9713	11.611	0.0088	1.74	0.6274
transport	11.006	0.0009	37.322	0.0000	9.763	0.056	0.8126	52.725	0.0000	26.32	0.0000
entertainment	36.386	0.0000	52.827	0.0000	15.335	2.338	0.1263	14.002	0.0029	11.50	0.0093
alcohol	58.415	0.0000	52.827	0.0000	15.335	4.914	0.0266	11.746	0.0087	59.89	0.0000
ready food	93.781	0.0000	52.827	0.0000	15.335	0.001	0.9704	30.470	0.0000	47.26	0.0000

Source: Authors' calculations

Table A 6. Final results (all households)

All households	food	staple	meat	dairy	fish	vegfruit	beverage	clothing
exptob	-0.0014809*** (0.0000909)	-0.0001999*** (0.0000259)	0.0002367*** (0.0000515)	-0.0005531*** (0.0000316)	-0.0001305*** (0.0000117)	-0.000313*** (0.000029)	0.0000738*** (0.0000161)	0.0024133*** (0.0000985)
lnM	-2.599998*** (0.0938203)	-0.0215375*** (0.0064127)	-0.2656093*** (0.0133758)	-0.3830513*** (0.0143863)	-0.0542993*** (0.0028465)	-0.2374402*** (0.0097091)	0.0620621*** (0.0033462)	0.6085383*** (0.0215836)
lnM2	0.1821989*** (0.0066208)	-0.0003607 (0.0004395)	0.0198609*** (0.0009391)	0.0260455*** (0.0009864)	0.0041485*** (0.0001965)	0.0159188*** (0.000672)	-0.0034354*** (0.0002318)	-0.0415448*** (0.0014895)
tob	-8.351746*** (0.3010868)	0.3194633*** (0.023879)	-1.46352*** (0.0486264)	-0.7704843*** (0.0469339)	-0.2789595*** (0.0079295)	-0.4446085*** (0.0301451)	0.2539749*** (0.0101049)	1.085904*** (0.0724309)
tob_lnM	2.443562*** (0.0859024)	-0.089963*** (0.0065135)	0.4310339*** (0.0135656)	0.22057*** (0.013025)	0.080636*** (0.0022382)	0.1398775*** (0.0084564)	-0.0529487*** (0.0028419)	-0.2886593*** (0.0205315)
tob_lnM2	-0.1739927*** (0.006086)	0.006796*** (0.0004564)	-0.0319124*** (0.0009688)	-0.0149173*** (0.0008974)	-0.0055448*** (0.0001598)	-0.0099794*** (0.0005955)	0.0024194*** (0.0002099)	0.0154999*** (0.0014495)
HHSize	0.0266436*** (0.0010465)	0.0065509*** (0.0002093)	0.0108137*** (0.0003561)	0.0090904*** (0.0002714)	-0.001759*** (0.0000742)	0.0074536*** (0.0002253)	-0.0029674*** (0.0001267)	-0.0085158*** (0.0005947)
mean_age	-0.0019509*** (0.0001448)	0.0001548*** (0.0000246)	0.0002059*** (0.0000453)	-0.000853*** (0.0000297)	-0.0000337*** (0.00000916)	-0.0000942*** (0.0000261)	0.0001658*** (0.0000137)	0.001286*** (0.000067)
maxduc	-0.0108246*** (0.0004892)	-0.0017568*** (0.000115)	-0.001558*** (0.0002041)	-0.000802*** (0.0001483)	0.00000329 (0.0000532)	-0.0044473*** (0.0001464)	-0.0006236*** (0.0000702)	0.0027698*** (0.0004024)
yeduc	0.0204833*** (0.0016007)	0.0059831*** (0.0003306)	0.0041852*** (0.0006027)	-0.0025884*** (0.0005191)	-0.0010357*** (0.0001331)	0.0095576*** (0.0003681)	0.0005391*** (0.0001924)	-0.0065501*** (0.001239)
rur_urb	-0.049988*** (0.0022923)	-0.0194522*** (0.0005823)	-0.02943*** (0.0010696)	0.001166* (0.0006891)	0.0044539*** (0.0002315)	-0.010873*** (0.0006717)	-0.003695*** (0.0003464)	-0.0580805*** (0.00206)
nchild5	-0.1675698*** (0.0056832)	-0.022905*** (0.001173)	-0.049884*** (0.0025383)	-0.0414786*** (0.0017447)	-0.0066892*** (0.0005291)	-0.0245229*** (0.0013313)	0.004905*** (0.0007595)	0.0822574*** (0.004301)

nchild15	-0.1072222***	-0.0183769***	-0.0315494***	-0.0327753***	0.0017361***	-0.0207108***	0.0048696***	0.0478944***
	(0.0050784)	(0.0008976)	(0.0022035)	(0.0014543)	(0.0003756)	(0.0011506)	(0.0005692)	(0.0030023)
adultshare	-0.5068938***	-0.0947026***	-0.1585326***	-0.0723257***	-0.0027437	-0.1141248***	-0.0200035***	0.0935403***
	(0.0239608)	(0.0039839)	(0.0102693)	(0.006612)	(0.0017171)	(0.0049593)	(0.0025612)	(0.0153729)
yr11	0.0282619***	0.0199515***	0.026616***	0.0017718**	-0.0030953***	0.0081804***	0.0067732***	0.0075375***
	(0.0025251)	(0.0005702)	(0.0007889)	(0.0007799)	(0.0002095)	(0.0006164)	(0.0002976)	(0.0026039)
yr15	-0.0689522***	-0.0089977***	-0.0055336***	0.0014334*	-0.0043659***	-0.0152331***	0.0161755***	0.0402553***
	(0.0026386)	(0.0006074)	(0.0010952)	(0.000788)	(0.0003088)	(0.0006514)	(0.0003563)	(0.0024569)
yr21	0.0235666***	0.0026603***	0.0066202***	0.0134368***	-0.0003718	0.0010866*	0.001611***	0.0072823***
	(0.0028616)	(0.0005785)	(0.0009353)	(0.0009477)	(0.0002358)	(0.0006508)	(0.0002996)	(0.0026874)
_cons	10.10072***	0.2787802***	1.068085***	1.569309***	0.1975982***	1.029645***	-0.2357456***	-2.330949***
	(0.3348579)	(0.0253533)	(0.0510221)	(0.0544222)	(0.011316)	(0.0372461)	(0.0136379)	(0.0852716)

All households	housing	goods	education	health	transport	entertainment	alcohol	ready	other
exptob	0.0008427***	-0.0002667***	-0.000374***	-0.0009214***	-0.0006436***	-0.0009389***	0.0004068***	0.0009803***	-0.0003365***
	(0.0000897)	(0.0000422)	(0.000018)	(0.0000451)	(0.0001184)	(0.0000527)	(0.0000714)	(0.0000348)	(0.0000358)
lnM	-0.033563**	-0.1571086***	-0.0898611***	-0.0945008***	-0.2659148 ***	-0.124187***	0.026728***	0.1655533***	0.0611785***
	(0.0158704)	(0.009616)	(0.0036883)	(0.0126159)	(0.021603)	(0.0094907)	(0.0050424)	(0.0074118)	(0.0069282)
lnM2	-0.0023914**	0.0122915***	0.0062499***	0.0065154***	0.0243767***	0.0100064***	-0.0016735***	-0.0109156***	-0.003878***
	(0.001137)	(0.0006759)	(0.0002632)	(0.000884)	(0.0015413)	(0.0006624)	(0.0003664)	(0.0005213)	(0.0004829)
tob	-0.473605***	-0.6079778***	-0.0068012	0.1912995***	2.749239***	-0.8747708***	0.1222949**	-0.2804787***	0.0897327***
	(0.0538834)	(0.0273115)	(0.0137401)	(0.0459611)	(0.071715)	(0.0301409)	(0.0510183)	(0.0267777)	(0.0215101)
tob_lnM	0.1119327***	0.1908179***	0.0040771	-0.0509348***	-0.7920345***	0.2533455***	-0.0255823*	0.0795556***	-0.0353079***
	(0.0151394)	(0.0077108)	(0.0039614)	(0.012825)	(0.0205143)	(0.0085096)	(0.0140432)	(0.0076012)	(0.0058791)

tob_lnM2	-0.0085092*** (0.0011326)	-0.0141019*** (0.0005606)	0.0000531 (0.0002965)	0.0048623*** (0.0009047)	0.0571522*** (0.0015343)	-0.0161618*** (0.0006225)	0.0005574 (0.0010039)	-0.0071023*** (0.0005536)	0.0037757*** (0.0004117)
HHSize	-0.0174934*** (0.0007054)	-0.0044163*** (0.0002258)	0.0011458*** (0.0001378)	0.0050133*** (0.0003294)	-0.0075849*** (0.0007668)	-0.0010487*** (0.0003133)	-0.0005086** (0.0002175)	-0.0098499*** (0.0002945)	-0.005281*** (0.0002603)
mean_age	-0.0003036*** (0.0000817)	0 .000162*** (0.000037)	-0.0000908*** (0.0000151)	0.0010121*** (0.0000378)	-0.0036076*** (0.0001102)	0.0001264*** (0.0000437)	0.0000627*** (0.0000152)	-0.00012*** (0.0000356)	-0.0003881*** (0.000027)
maxduc	0.0073506*** (0.0003986)	-0.0016533*** (0.000159)	0.002789*** (0.0000791)	-0.0002675 (0.0001861)	0.0006768 (0.0004783)	-0.002583*** (0.0002383)	0.0000806 (0.0001186)	0.0041637*** (0.0001507)	0.0004221*** (0.0001337)
yeduc	-0.0134995*** (0.0009579)	0.0082895*** (0.0004213)	-0.0039899*** (0.0002083)	-0.0036077*** (0.0006129)	-0.0081798*** (0.0010991)	0.0013063** (0.0005714)	-0.0000866 (0.000241)	-0.0084612*** (0.0004354)	-0.0014267*** (0.0003834)
rur_urb	0.022837*** (0.0019671)	-0.0048255*** (0.0008956)	0.0125106*** (0.0004021)	0.0236839*** (0.0011099)	0.0024918 (0.0024815)	0.0021285** (0.0009905)	-0.0038336*** (0.0003581)	-0.0241231*** (0.0007229)	0.0011654 (0.0007392)
nchild5	0.207113*** (0.0050905)	0.0040585** (0.0017342)	-0.0243876*** (0.0013209)	-0.0832946*** (0.0028333)	-0.0462914*** (0.0053378)	-0.0331816*** (0.002473)	0.0007716 (0.0009512)	0.0337767*** (0.0018203)	0.0084347*** (0.0017184)
nchild15	0.1809915*** (0.0042576)	0.0035484*** (0.0012235)	-0.0633811*** (0.0017349)	-0.109804*** (0.0024929)	-0.0275572*** (0.0039798)	-0.0202198*** (0.002037)	0.0016144* (0.0009004)	0.0335792*** (0.0014441)	0.0093074*** (0.0012733)
adultshare	0.7082845*** (0.0175666)	-0.0027492 (0.0049998)	-0.230572*** (0.0072317)	-0.4811901*** (0.0112866)	0.1945979*** (0.0169135)	-0.0692671*** (0.008703)	0.0060259 (0.0037068)	0.1525636*** (0.0060279)	0.0371088*** (0.0056189)
yr11	-0.0160597*** (0.0018724)	-0.0041262*** (0.0006183)	-0.0229528*** (0.0006531)	-0.022362*** (0.0009246)	-0.0041127** (0.0019798)	-0.0166114*** (0.0008599)	0.0094479*** (0.0009076)	-0.0026045*** (0.0008139)	0.0497838*** (0.0005155)

yr15	0.0357222*** (0.0024436)	-0.013166*** (0.000934)	-0.0294093*** (0.0007592)	-0.0260421*** (0.001055)	-0.0204784*** (0.0025878)	-0.0300222*** (0.0012382)	0.0059095*** (0.000635)	0.0169892*** (0.0010253)	0.023211*** (0.0007476)
yr21	0.0188894*** (0.0022364)	-0.0083466*** (0.0007872)	-0.0212377*** (0.0007089)	-0.0380144*** (0.0010274)	0.0211275*** (0.002482)	0.0228141*** (0.0011499)	0.0003077 (0.0005963)	0.0051902*** (0.0011408)	-0.0027906*** (0.0005906)
_cons	-0.1219989* (0.0647081)	0.5140562*** (0.0375703)	0.5686173*** (0.0165791)	0.8239434*** (0.0474522)	0.8179076*** (0.0890414)	0.4919385*** (0.0390489)	-0.1084768*** (0.0174737)	-0.7271611*** (0.0296607)	-0.2230719*** (0.028264)

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

Source: Authors' calculations

Table A 7. Final results (high-income households)

High-income households	food	staple	meat	dairy	fish	vegfruit	beverage	clothing
exptob	-0.0025751*** (0.0005159)	-0.0000623** (0.0000241)	0.000179*** (0.0000551)	0.0000378 (0.0000293)	0.0000265** (0.0000116)	-0.0001427*** (0.0000353)	-0.0000291* (0.0000151)	-0.0000994* (0.0000606)
lnM	3.265965*** (0.7332845)	-0.0331916*** (0.0118839)	0.1189371*** (0.0254315)	-0.0154547 (0.0124233)	0.0201728*** (0.0057965)	0.0589706*** (0.0165635)	0.0414741*** (0.0068231)	0.0075323 (0.0301149)
lnM2	-0.2178914*** (0.0487308)	0.0014117* (0.000783)	-0.0081578*** (0.0016786)	0.000151 (0.0008161)	-0.0011858*** (0.0003852)	-0.0041011*** (0.0010917)	-0.002726*** (0.0004534)	0.000175 (0.0020497)
tob	11.13135*** (2.684653)	-0.1675691*** (0.0595374)	0.345655*** (0.1324951)	-0.0015935 (0.0621563)	0.0369699 (0.0319937)	-0.05689 (0.0837928)	-0.018076 (0.0356173)	-0.1287485 (0.1506526)
tob_lnM	-2.977311*** (0.7182392)	0.0438622*** (0.0155225)	-0.0878676** (0.0349583)	0.0007396 (0.0161909)	-0.0089725 (0.0083573)	0.0126227 (0.0219974)	0.0040273 (0.0093736)	0.0357514 (0.040334)

tob_lnM2	0.2027875***	-0.0027191***	0.005292**	-0.0001239	0.0004922	-0.0004156	-0.0001439	-0.002345
	(0.047908)	(0.0010041)	(0.0022916)	(0.0010467)	(0.0005405)	(0.0014318)	(0.000611)	(0.0026759)
HHSize	0.0278784***	0.0031509***	0.0061618***	0.0042896***	0.0003324*	0.0042023***	0.0006095***	-0.0015122*
	(0.0031638)	(0.0003028)	(0.000716)	(0.0003184)	(0.0001731)	(0.0004899)	(0.0002061)	(0.0008978)
mean_age	0.0015451***	0.000091***	0.0002894***	0.0002365***	0.0000787***	0.0003742***	-0.0000148	-0.0011036***
	(0.0001515)	(0.0000168)	(0.0000356)	(0.0000176)	(0.00000989)	(0.0000242)	(0.0000112)	(0.0000507)
maxduc	-0.0078586***	-0.0002201*	-0.0006336**	-0.0002891**	-0.0001121*	-0.0002822	-0.0001227	0.0013552***
	(0.0014125)	(0.0001195)	(0.0002679)	(0.0001255)	(0.0000605)	(0.0001853)	(0.0000794)	(0.0003596)
yeduc	0.0035489	-0.0015882***	-0.0010178*	0.0000172	0.0003251**	-0.0003778	-0.0007753***	-0.0005528
	(0.0027908)	(0.0002632)	(0.0005779)	(0.0002871)	(0.0001375)	(0.0004237)	(0.0001736)	(0.0007629)
rur_urb	-0.0226033***	-0.002532***	-0.0154125***	0.0000622	0.0006733***	0.0007397	-0.0014418***	0.0065946***
	(0.0038968)	(0.0004328)	(0.0010074)	(0.0004543)	(0.0002276)	(0.0006354)	(0.00029)	(0.0010551)
nchild5	0.0334612*	-0.0025489*	-0.0075119**	-0.0050953***	-0.0015723**	-0.0052657**	-0.0013031	-0.0023673
	(0.01951)	(0.0014953)	(0.0032432)	(0.0014743)	(0.000728)	(0.0023104)	(0.0012116)	(0.0051335)
nchild15	0.0265653	-0.0014691	-0.0040332	-0.0056244***	-0.0004852	-0.0033527	0.0000198	0.0091955**
	(0.0178292)	(0.0013619)	(0.0029201)	(0.0012732)	(0.0006663)	(0.0021219)	(0.001203)	(0.0045246)
adultshare	0.0793343	-0.0043943	-0.0107144	-0.0310588***	-0.003418	-0.0091786	0.0001681	0.0490395***
	(0.06549)	(0.0057012)	(0.0114055)	(0.0054597)	(0.0027494)	(0.0084817)	(0.0045875)	(0.0176308)
yr11	-0.0708557***	-0.0037114***	-0.0020253	0.0011787	-0.0020667***	-0.0034454**	-0.0001936	0.0010449
	(0.0109395)	(0.0009624)	(0.0019634)	(0.0009437)	(0.0004654)	(0.0014702)	(0.0005249)	(0.0021796)
yr15	-0.0229154***	-0.0067028***	-0.0066127***	-0.0003803	-0.000676*	0.0001148	0.0113296***	0.0035459*
	(0.008446)	(0.0008956)	(0.001837)	(0.0008724)	(0.0004077)	(0.0012987)	(0.000507)	(0.0020474)
yr21	0.0119075	-0.0023313**	-0.0036521*	0.000745	-0.0007739*	0.0063712***	0.0011786***	0.0040584**
	(0.0080107)	(0.0009161)	(0.0018951)	(0.0009185)	(0.0004474)	(0.0013773)	(0.0004598)	(0.0020558)
_cons	-11.97082***	0.2207404***	-0.3525742***	0.1619063***	-0.0761394***	-0.1714204***	-0.1376488***	-0.0264642
	(2.777087)	(0.0458565)	(0.0967706)	(0.0479346)	(0.0223349)	(0.0642068)	(0.0261496)	(0.1136644)

High-income households	housing	goods	education	health	transport	entertainment	alcohol	ready	other
exptob	0.0002469** (0.0001238)	-0.0003155*** (0.0000545)	0.00000706 (0.000017)	-0.0000459*** (0.0000131)	0.0000221 (0.0001188)	0.0000681** (0.000031)	0.0000854*** (0.0000229)	0.0005847*** (0.0000561)	0.000173*** (0.0000485)
lnM	-0.3223471*** (0.0515269)	0.1430985*** (0.0314174)	-0.0440603*** (0.0107867)	-0.0647524 (0.0426539)	-0.0927868 (0.0824272)	-0.0553703** (0.0269253)	0.0396665*** (0.0091643)	0.0137235 (0.0184068)	0.1761516*** (0.0233692)
lnM2	0.0148628*** (0.0033867)	-0.0076839*** (0.0021201)	0.0029389*** (0.0007605)	0.0053509* (0.0029239)	0.0121155** (0.0056628)	0.0040024** (0.0018285)	-0.0023586*** (0.0006022)	-0.0006093 (0.0012257)	-0.0103844*** (0.0015555)
tob	-0.0124563 (0.2620835)	0.104424 (0.1634224)	-0.1070391** (0.0488269)		-0.5277762 (0.4049644)	-0.1000528 (0.1163532)	0.1563284*** (0.0554699)	0.390433*** (0.1400741)	0.0415456 (0.1151048)
tob_lnM	-0.021952 (0.0687311)	-0.0281633 (0.0437767)	0.0266416** (0.0133939)		0.1586833 (0.1098174)	0.025207 (0.031462)	-0.0370787** (0.0145388)	-0.0998232*** (0.0368303)	-0.0119652 (0.0306407)
tob_lnM2	0.0024361 (0.0044869)	0.0024468 (0.0029177)	-0.0016634* (0.0009177)		-0.0117163 (0.0073784)	-0.0016643 (0.0021127)	0.0020768** (0.0009439)	0.0053323** (0.0024011)	0.0005869 (0.0020192)
HHSize	-0.0002526 (0.0015382)	-0.005075*** (0.0010542)	0.0010232* (0.0005383)	-0.0010457 (0.0011393)	-0.0090121*** (0.0020536)	-0.0024306*** (0.0005348)	-0.0006276** (0.0002833)	-0.0088489*** (0.0007768)	-0.0053896*** (0.0008573)
mean_age	0.0010467*** (0.0000815)	0.0001017** (0.0000473)	-0.0002424*** (0.000022)	0.000956*** (0.0000519)	-0.0013059*** (0.0000779)	-0.000076*** (0.0000215)	0.0000718*** (0.0000147)	-0.0007241*** (0.0000383)	-0.0001585*** (0.0000415)
maxduc	0.0014027** (0.0005576)	-0.0015164*** (0.0003566)	0.0006394*** (0.0001227)	-0.0010959*** (0.0003958)	0.0002456 (0.0007232)	0.0009725*** (0.0001921)	-0.000159 (0.0001066)	0.0019136*** (0.0002647)	0.0002853 (0.0002393)
yeduc	0.0048521*** (0.0012697)	0.0015823* (0.0008184)	-0.0016807*** (0.0002677)	-0.0026036*** (0.0008766)	0.0020178 (0.0015177)	-0.0004223 (0.0003997)	0.0003498 (0.0002317)	-0.0014965*** (0.0005739)	-0.0011001** (0.0005244)

rur_urb	0.0419243*** (0.0020051)	- 0.0041747*** (0.0011679)	0.0025939*** (0.0003685)	0.0024684* (0.0013455)	-0.0348651*** (0.0019529)	0.0057377*** (0.0005745)	-0.0048639*** (0.000365)	0.0033258*** (0.0008392)	0.0041545*** (0.0008723)
nchild5	0.0159218** (0.0064656)	0.0079091 (0.0051468)	- 0.0051055** (0.0021199)	0.004638 (0.0074321)	0.0018634 (0.0094815)	-0.0016518 (0.0029681)	0.0035072*** (0.0010945)	0.0100015*** (0.0037113)	0.0080125** (0.0039188)
nchild15	0.0101795* (0.0059809)	0.0014188 (0.0048156)	-0.0063229*** (0.0019544)	-0.0020491 (0.0066125)	-0.0064816 (0.0081609)	0.0069931*** (0.0027004)	0.0032587*** (0.0010452)	0.0124183*** (0.0033205)	0.0041531 (0.003377)
adultshare	0.007907 (0.0245052)	-0.0234769 (0.0192711)	-0.0034235 (0.0084689)	-0.0241932 (0.0247177)	0.0346615 (0.0326076)	-0.0029528 (0.0095719)	0.0120673*** (0.0040951)	0.0573728*** (0.013318)	0.0131764 (0.013944)
yr11	0.0256961*** (0.0040635)	0.0027144 (0.0024113)	0.0017228*** (0.0006305)	0.0055452** (0.0024156)	-0.0159656*** (0.0047001)	0.0169477*** (0.0012269)	0.0064296*** (0.0006696)	0.005971*** (0.0019704)	0.0550428*** (0.001425)
yr15	0.0191982*** (0.0035671)	0.0022033 (0.0022042)	0.0007406 (0.0005086)	0.009258*** (0.0023698)	-0.0234662*** (0.0042157)	0.0071204*** (0.0011005)	0.0048099*** (0.0005755)	0.0028798 (0.0018336)	0.0387678*** (0.001175)
yr21	0.0020492 (0.0035436)	0.0050557** (0.00224)	0.0013784** (0.00059)	-0.0003318 (0.0024427)	-0.007782* (0.0045721)	0.0019518 (0.0012767)	0.0012325** (0.0006279)	-0.0013939 (0.0019024)	-0.0046802*** (0.0007671)
_cons	1.622211*** (0.2010391)	- 0.5496603*** (0.1199931)	0.1828906*** (0.0397253	0.2252413 (0.1634935)	0.1867864 (0.3070316)	0.1990248** (0.0996054)	-0.1713757*** (0.0355605)	-0.064905 (0.071415)	-0.7138331*** (0.0904357)

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

Source: Authors' calculations

Table A 8. Final results (middle-income households)

Middle-income households	food	staple	meat	dairy	fish	vegfruit	beverage	clothing
exptob	-0.0022691*** (0.0007258)	0.0000239*** (0.00000551)	0.0003229*** (0.0000763)	0.0000619 (0.0000415)	-0.0000243 (0.0000179)	-0.0001114** (0.0000488)	-0.0000641*** (0.0000235)	-0.0000697 (0.0000762)
lnM	2.2994*** (0.6480949)	-0.0076022 (0.0146444)	0.1436348*** (0.0304065)	0.0292022* (0.0163366)	-0.0197828** (0.0079167)	0.0815413*** (0.0207866)	0.0329329*** (0.0087506)	-0.1545778*** (0.0281254)
lnM2	-0.1654156*** (0.0469407)	-0.000167 (0.00103)	-0.0094518*** (0.0022143)	-0.0028064** (0.0011721)	0.0015837*** (0.0005673)	-0.005897*** (0.0014808)	-0.002199*** (0.0006378)	0.0117197*** (0.0021035)
tob	7.955063*** (2.048213)	-	0.4295622*** (0.1633575)	0.1884987** (0.0909116)	-0.0834276** (0.0327844)	0.0617315 (0.1077289)	0.0991238** (0.0475637)	-0.5052275*** (0.123502)
tob_lnM	-2.256583*** (0.5856871)	-	-0.1055932** (0.0458234)	-0.0520599** (0.0253228)	0.0235107** (0.0092659)	-0.0153799 (0.0300558)	-0.027934** (0.0132411)	0.1426866*** (0.0353293)
tob_lnM2	0.1629122*** (0.042026)	-	0.0059377* (0.0032102)	0.0034898** (0.0017647)	-0.0016176** (0.0006573)	0.0011445 (0.0020991)	0.0020792** (0.0009199)	-0.0099195*** (0.0025151)
HHSize	0.0279706*** (0.0076013)	-0.0000922 (0.0005478)	0.001883 (0.0013862)	0.0026354*** (0.0006318)	-0.0005764** (0.0002864)	0.0023435*** (0.0007404)	-0.0002659 (0.0003353)	0.0023569* (0.001295)
mean_age	0.0010919*** (0.0001341)	0.0000271 (0.0000247)	0.0003953*** (0.0000476)	0.0002812*** (0.0000277)	0.0000237* (0.0000126)	0.0002053*** (0.0000324)	-0.0000704*** (0.0000142)	-0.0008018*** (0.0000482)
maxduc	-0.0053716*** (0.0011448)	-0.0003466** (0.0001525)	-0.0006202** (0.0002854)	0.000121 (0.0001513)	-0.00000145 (0.0000703)	-0.0004376** (0.0001781)	-0.0001351* (0.0000809)	0.0010781*** (0.0002986)
yeduc	-0.003499* (0.002019)	-0.0017551*** (0.0003463)	-0.0004291 (0.000626)	-0.0012173*** (0.0003511)	0.000086 (0.0001668)	-0.0005366 (0.0004361)	-0.0006059*** (0.0001768)	-0.0007853 (0.000665)
rur_urb	-0.0355358*** (0.0031949)	-0.0038665*** (0.0005407)	-0.0176179*** (0.0009103)	-0.003233*** (0.0005549)	0.0006696*** (0.0002576)	-0.004738*** (0.0006639)	-0.0021732*** (0.0003022)	0.0028355*** (0.0009551)

nchild5	0.0421062***	0.0001233	0.0060892*	0.0016999	0.0026734***	0.0011582	0.0011677	-0.017408***
	(0.0128442)	(0.0014871)	(0.0033078)	(0.0015846)	(0.0007539)	(0.0020573)	(0.0010056)	(0.0034953)
nchild15	0.0251827**	0.0020113	0.0029175	-0.0012236	0.0024199***	0.0011467	0.0005589	-0.0100291***
	(0.0118903)	(0.00139)	(0.0028941)	(0.0014797)	(0.0006869)	(0.0019343)	(0.0008245)	(0.003311)
adultshare	0.0817342*	0.0072157	0.0091835	-0.0081393	0.011529***	0.0069208	0.0008325	-0.0274761*
	(0.0469947)	(0.0062328)	(0.0128593)	(0.0066546)	(0.0030602)	(0.0085221)	(0.0035917)	(0.015067)
yr11	-0.0328222***	0.0025116**	0.0092121***	0.0050042***	-0.0017687***	0.0051287***	-0.0001107	-0.00107
	(0.0103856)	(0.0011116)	(0.0021692)	(0.0010795)	(0.0005429)	(0.0013926)	(0.0005398)	(0.0020648)
yr15	-0.0112473	-0.0036225***	0.0043949**	0.0045083***	-0.0003068	0.0072615***	0.0116497***	0.0019247
	(0.0082484)	(0.0011173)	(0.0021271)	(0.0010421)	(0.0005399)	(0.0012885)	(0.0005864)	(0.0019634)
yr21	0.0182308**	-0.0045799***	-0.0022858	-0.0004296	-0.000478	0.0090653***	0.000526	0.0023366
	(0.0082493)	(0.0010674)	(0.0020157)	(0.0009822)	(0.0005202)	(0.001352)	(0.0004998)	(0.0019844)
_cons	-7.711327***	0.1208873**	-0.487171***	-0.0239746	0.0577956**	-0.242237***	-0.1002652***	0.5918823***
	(2.251763)	(0.0543686)	(0.1078117)	(0.0583477)	(0.0284688)	(0.0751521)	(0.030551)	(0.0967141)

Middle-income households	housing	goods	education	health	transport	entertainment	alcohol	ready	other
exptob	0.0002856**	-0.0003382***	-0.0000402	-0.0001795**	0.0002486**	0.00000216	0.0001088***	0.0003898***	-0.0000733
	(0.0001441)	(0.0000617)	(0.0000249)	(0.0000769)	(0.0001192)	(0.00000582)	(0.0000341)	(0.0000455)	(0.0000512)
lnM	-0.2275538***	-0.0098685	-0.0491534***	0.0967424***	-0.0632997	-0.0435379***	0.0471937***	-0.0860189***	0.1564342***
	(0.0550423)	(0.024693)	(0.0089167)	(0.0332401)	(0.0494048)	(0.0117811)	(0.0111933)	(0.0175413)	(0.0201242)
lnM2	0.0089778**	0.00238	0.003447***	-0.00667***	0.0100752***	0.0033693***	-0.0027934***	0.0065029***	-0.0106757***
	(0.0039604)	(0.0018379)	(0.0006777)	(0.0023622)	(0.0036802)	(0.0008633)	(0.0008033)	(0.0012964)	(0.0014812)
tob	0.3527745	-0.0188112	-0.0350213	-0.157151	-0.3188201	-	0.496434***	-0.0856199	0.1304211
	(0.291584)	(0.1116121)	(0.0402943)	(0.1503996)	(0.2049617)		(0.0904911)	(0.0957722)	(0.0899502)
tob_lnM	-0.1088149	0.000317	0.0095422	0.0387043	0.0879894	-	-0.1311171***	0.0289124	-0.0408483
	(0.0809535)	(0.032142)	(0.0117994)	(0.0420759)	(0.0590935)		(0.0248841)	(0.0269923)	(0.0253339)

tob_lnM2	0.0076226 (0.0056254)	0.000875 (0.0023166)	-0.0006121 (0.0008666)	-0.0020969 (0.0029486)	-0.0064104 (0.0042426)	-	0.0084705*** (0.0017135)	-0.0029607 (0.0019063)	0.0032568* (0.0017783)
HHSize	0.0004643 (0.0020554)	-0.0050539*** (0.00104)	0.0016593*** (0.0005286)	0.0017459 (0.0011448)	-0.0080127*** (0.0020178)	-0.001391** (0.0005289)	-0.0007278 (0.0004498)	-0.0023838*** (0.000782)	0.0018025** (0.0007988)
mean_age	0.0006009*** (0.0000953)	-0.0000006 (0.0000404)	-0.0001696*** (0.0000165)	0.0009651*** (0.0000514)	-0.0007853*** (0.0000709)	-0.0001313*** (0.000025)	0.0001335*** (0.0000177)	-0.0004377*** (0.0000345)	-0.0002414*** (0.0000348)
maxduc	-0.0007896 (0.0005039)	0.000021 (0.000245)	0.0005004*** (0.0001148)	-0.0008488*** (0.0003104)	-0.0009339** (0.0004698)	0.0006142*** (0.0001477)	-0.0002426** (0.0001008)	0.0008063*** (0.0001781)	0.0002556 (0.0001862)
yeduc	0.0094369*** (0.0012075)	-0.0019701*** (0.0005519)	-0.0008181*** (0.0002274)	-0.0034958*** (0.0007208)	0.0048539*** (0.0010717)	-0.0005418* (0.0003268)	0.0006321*** (0.0002172)	-0.000474 (0.0003884)	-0.0006924* (0.0004096)
rur_urb	0.0599485*** (0.0019856)	-0.0057315*** (0.0008458)	0.0022144*** (0.0003746)	-0.0004531 (0.0010737)	-0.0265369*** (0.0015542)	0.0044516*** (0.0004796)	-0.0046149*** (0.0003503)	0.0016336*** (0.0005992)	-0.0012805* (0.0006963)
nchild5	0.0120071** (0.0054443)	0.0073718** (0.0030466)	-0.0033333*** (0.0012664)	0.0133373*** (0.002456)	-0.0211142*** (0.0055892)	-0.0038712** (0.0018874)	0.0008548 (0.0011589)	-0.0050574** (0.0020816)	0.0052872** (0.0026314)
nchild15	0.020053*** (0.0049736)	0.0028793 (0.0026222)	-0.0042488*** (0.0011733)	0.0052839** (0.0023609)	-0.0209797*** (0.0052293)	0.0040211** (0.0017951)	0.0017944 (0.001127)	-0.0017809 (0.0019762)	-0.0020992 (0.0026022)
adultshare	0.0368983 (0.023265)	0.0184337* (0.0111412)	-0.0009305 (0.0050525)	0.020748** (0.010438)	-0.0960347*** (0.0223616)	-0.0018781 (0.0078835)	0.002218 (0.0047137)	0.0084744 (0.0088057)	-0.0067032 (0.0113656)
yr11	0.0036379 (0.0037907)	-0.0043835** (0.0018749)	0.0011372* (0.000656)	-0.0039328 (0.002519)	-0.0052578 (0.0034271)	0.0101967*** (0.0011324)	0.0091756*** (0.0006606)	-0.0006162 (0.0013411)	0.0381449*** (0.0011454)
yr15	0.0017807 (0.0036312)	0.0012292 (0.0017441)	0.0004509 (0.0006414)	-0.0065602*** (0.0023285)	-0.0081738** (0.0033129)	0.0054599*** (0.0010947)	0.0059077*** (0.0005793)	0.0006605 (0.0012774)	0.025272*** (0.0010646)
yr21	0.0057478* (0.0034657)	0.0035189** (0.0017372)	0.00044 (0.0005571)	-0.0008114 (0.0023755)	-0.009521*** (0.0035781)	-0.0008029 (0.0011806)	0.0007428 (0.0005739)	-0.001448 (0.0013319)	-0.0010058 (0.0007299)
_cons	1.232319*** (0.195763)	-0.0022827 (0.0853026)	0.1819637*** (0.0296696)	-0.3515739*** (0.1186214)	0.1792096 (0.1700241)	0.1559152*** (0.0422011)	-0.1965858*** (0.0397792)	0.3102298*** (0.0605385)	-0.5380134*** (0.0716593)

Source: Authors' calculations

Table A 9. Final results (low-income households)

Low-income households	food	staple	meat	dairy	fish	vegfruit	beverage	clothing
exptob	-0.0001006 (0.0007924)	0.0000554*** (0.00000952)	0.0007225*** (0.0001393)	0.0004771*** (0.000101)	0.0000192 (0.0000246)	0.00022** (0.0000985)	-0.000194*** (0.0000403)	-0.0003396*** (0.0001047)
lnM	2.081622*** (0.3156336)	0.0796808*** (0.0186026)	0.1447109*** (0.0181727)	0.1285559*** (0.0161403)	-0.0173418* (0.0092331)	0.1192593*** (0.017692)	0.0161166** (0.0057375)	-0.1406797*** (0.0124687)
lnM2	-0.1575102*** (0.024279)	-0.0064309*** (0.0013728)	-0.0093082*** (0.0014219)	-0.0099539*** (0.0012285)	0.0015516** (0.000689)	-0.0096711*** (0.0013536)	-0.0009742** (0.0004344)	0.0126389*** (0.0010151)
tob	4.866025*** (1.066686)	-	-0.2540412 (0.1503321)	-0.0352133 (0.1340122)	-0.0869112*** (0.032647)	-0.2277196** (0.1100769)	0.0341383 (0.0519463)	-0.0432281 (0.0875857)
tob_lnM	-1.457904*** (0.3274608)	-	0.0868077* (0.0450242)	0.0208915 (0.0396527)	0.0268755*** (0.0098263)	0.0715717** (0.0327094)	-0.0090902 (0.0153725)	0.0119422 (0.0271563)
tob_lnM2	0.1088232*** (0.0253948)	-	-0.0082163** (0.0034425)	-0.0028991 (0.0029745)	-0.002093*** (0.0007497)	-0.005878** (0.0024786)	0.0009131 (0.00116)	-0.0003461 (0.0021785)
HHSize	0.0113319*** (0.0025472)	-0.0003513 (0.0005827)	-0.0023309** (0.0009365)	0.0025266*** (0.0007045)	-0.0006132*** (0.0001536)	0.0038294*** (0.0006449)	-0.0005366** (0.0002717)	-0.002134*** (0.0007441)
mean_age	0.0006572*** (0.0001422)	-0.0000137 (0.0000382)	0.0001835** (0.0000608)	0.0002884*** (0.0000405)	0.000037*** (0.000011)	0.0000228 (0.0000448)	-0.0000904*** (0.0000184)	-0.0005227*** (0.0000476)
maxduc	-0.0032343*** (0.0008156)	-0.0009397*** (0.0001923)	-0.0005115 (0.0003079)	-0.0002198 (0.000236)	-0.0000599 (0.000059)	-0.0001268 (0.0002293)	0.0000855 (0.0000963)	0.0003364 (0.0002664)

yeduc	-0.0107975***	-0.0008404	-0.0008486	-0.0014778***	0.000229	-0.0016849**	-0.0010869***	-0.000591
	(0.0020828)	(0.0005031)	(0.0007802)	(0.0005404)	(0.0001653)	(0.0005538)	(0.0002293)	(0.0006188)
rur_urb	-0.0424704***	-0.0024575***	-0.0126651***	-0.0046959***	0.0010487***	-0.0117059***	-0.0021152***	0.0017352
	(0.0029996)	(0.0007432)	(0.0011691)	(0.0007704)	(0.0002263)	(0.0008639)	(0.0003638)	(0.000967)
nchild5	0.0335585***	-0.0037068**	0.0102042**	0.0074056***	0.0013993***	-0.0002722	0.0009889	-0.0054866**
	(0.0072591)	(0.0017102)	(0.0032511)	(0.0022576)	(0.0004933)	(0.0020324)	(0.0009201)	(0.0027317)
nchild15	0.0316422***	0.0015117	0.0126438***	0.0034243*	0.0011055**	0.0023214	-0.0000568	-0.0016228
	(0.0067397)	(0.0017479)	(0.0031578)	(0.0020363)	(0.0005241)	(0.0019367)	(0.0008802)	(0.0027361)
adultshare	0.1299862***	0.0005377	0.0509014***	0.0070956	0.0032893	0.0120177	0.0030825	-0.0065605
	(0.0316657)	(0.00817)	(0.0142952)	(0.0096353)	(0.0024226)	(0.009036)	(0.0042007)	(0.0125489)
yr11	0.0278835***	0.0101817***	0.0137169***	0.0112361***	-0.0008411**	0.0166307***	0.0004725	0.0022114
	(0.0062663)	(0.0016554)	(0.0022621)	(0.0015616)	(0.0004262)	(0.0013414)	(0.0006029)	(0.0020285)
yr15	0.0176287***	-0.0006231	0.0128333***	0.0082865***	0.0002784	0.0137093***	0.0125365***	0.0059919**
	(0.0064717)	(0.0015946)	(0.0021334)	(0.0015198)	(0.0004088)	(0.0013968)	(0.0006236)	(0.0020113)
yr21	0.0171029***	-0.0048913***	-0.0018442	-0.0010704	-0.0000111	0.0119768***	0.001981***	-0.0022644
	(0.0061332)	(0.0014099)	(0.0021679)	(0.001453)	(0.0004656)	(0.001437)	(0.0005949)	(0.0019714)
_cons	-6.592783***	-0.1720144**	-0.5217733***	-0.3806148***	0.048472	-0.3219004***	-0.0440922**	0.4343408***
	(1.028774)	(0.0645307)	(0.059711)	(0.0545723)	(0.0308538)	(0.059499)	(0.0196385)	(0.0391366)

Low-income households	housing	goods	education	health	transport	entertainment	alcohol	ready	other
exptob	-0.00000321	-0.0002745***	-0.00000293	0.0000192	0.0003426**	-0.0000172***	0.000039	0.0003802***	-0.0002013***
	(0.0002189)	(0.0000808)	(0.00000437)	(0.0000134)	(0.0001526)	(0.00000659)	(0.0000541)	(0.0000532)	(0.000074)
lnM	-0.3356474***	0.0375232***	-0.0247317***	0.0877005***	-0.2050742***	-0.0216511***	-0.001576	-0.0438598***	0.0952544***
	(0.0522645)	(0.0113878)	(0.003059)	(0.0163997)	(0.0185581)	(0.0056301)	(0.0061682)	(0.0059528)	(0.0100462)

lnM2	0.0164117***	-0.0017938**	0.0020775***	-0.0058685***	0.0194958***	0.0018507***	0.0004649	0.0038961***	-0.0068854***
	(0.0039182)	(0.0008968)	(0.0002457)	(0.0012129)	(0.0015197)	(0.000435)	(0.0004652)	(0.0004861)	(0.000785)
tob	0.0711865	0.1556335**	-	-	-0.4806612***	-	0.2514367***	-0.0134005	0.2594456**
	(0.2372053)	(0.0720607)			(0.1367501)		(0.0843071)	(0.0823651)	(0.0838783)
tob_lnM	-0.0403473	-0.0553043**	-	-	0.1461862***	-	-0.0704878***	0.0087847	-0.0809471***
	(0.0708709)	(0.0220451)			(0.0423106)		(0.0245935)	(0.0246348)	(0.0249558)
tob_lnM2	0.0041496	0.0050648***	-	-	-0.0114677***	-	0.0049041***	-0.001503	0.0065483***
	(0.0054342)	(0.0017323)			(0.0033621)		(0.0018189)	(0.0018608)	(0.0019009)
HHSize	-0.0030669**	-0.0023677***	0.0001996	0.000146	-0.0016589	-0.0008273**	-0.0004238	-0.0016811***	0.0015941***
	(0.0013541)	(0.0005431)	(0.0001955)	(0.0006928)	(0.0010216)	(0.0003214)	(0.0002801)	(0.0004109)	(0.0005337)
mean_age	0.0004509***	-0.0000626	-0.0000821***	0.0008185***	-0.0007229***	-0.0001793***	0.0000252	-0.0002626***	-0.0001896***
	(0.0001005)	(0.0000393)	(0.0000133)	(0.0000549)	(0.0000629)	(0.0000221)	(0.0000197)	(0.0000248)	(0.0000352)
maxduc	0.0018374***	-0.0002121	0.0001532**	-0.0015342***	0.0005248	0.0003557***	-0.0003521***	0.0004928***	0.0007991***
	(0.0004952)	(0.0001941)	(0.0000763)	(0.0002826)	(0.0003851)	(0.000108)	(0.0000959)	(0.000147)	(0.0001814)
yeduc	0.0053272***	-0.0007006	0.0000981	-0.0027009***	0.0011274	-0.0003917	0.0004798**	-0.000483	-0.0009483**
	(0.0013181)	(0.0005193)	(0.000189)	(0.0007435)	(0.0009276)	(0.0002909)	(0.0002348)	(0.0003278)	(0.0004161)
rur_urb	0.0620102***	-0.0044066***	0.0014789***	-0.0026022**	-0.0250641***	0.0025931***	-0.00331***	-0.0020846***	-0.0030476***
	(0.0020164)	(0.0008004)	(0.000275)	(0.0010479)	(0.0014069)	(0.0004837)	(0.0003457)	(0.000472)	(0.0007806)
nchild5	0.0137379***	0.0032396	-0.0023337***	0.0024051	-0.0135284***	-0.0059899***	0.0013804	-0.0027557*	0.0025999
	(0.0041587)	(0.0020122)	(0.0005062)	(0.0019978)	(0.003265)	(0.0010684)	(0.0007848)	(0.0014624)	(0.0017972)
nchild15	0.0152268***	0.0018267	-0.0015819***	-0.0038982*	-0.0142547***	0.0026123**	0.001455	-0.0010778	-0.0089022***
	(0.0040238)	(0.0018183)	(0.0005449)	(0.0020171)	(0.0032593)	(0.0010608)	(0.0008069)	(0.0013722)	(0.0016975)
adultshare	0.050024***	0.008764	0.0030038	-0.0111645	-0.0542547***	-0.0044379	0.009948***	0.0054373	-0.0340307***
	(0.0189827)	(0.0087789)	(0.002483)	(0.0097672)	(0.0155584)	(0.0051765)	(0.0037363)	(0.006307)	(0.0079224)
yr11	-0.0295171***	-0.0007057	0.0020811***	-0.0014912	-0.0171173***	0.0065119***	0.0045955***	-0.0037191***	0.0356707***
	(0.0037938)	(0.0016594)	(0.0004841)	(0.0022605)	(0.0030327)	(0.0010461)	(0.000619)	(0.0010831)	(0.0010425)

yr15	-0.0174339***	0.0012446	0.0014892***	-0.005522***	-0.0183166***	0.0076129***	0.0031902***	0.0007026	0.0265802***
	(0.0038136)	(0.0016068)	(0.0004931)	(0.0021234)	(0.0029447)	(0.0010387)	(0.0005581)	(0.0010733)	(0.0010141)
yr21	0.0093252**	0.000558	0.0001592	-0.0002766	-0.0112268***	-0.0021252**	0.00086	-0.0014666	0.0011593
	(0.0037213)	(0.0017485)	(0.0005106)	(0.0021366)	(0.0031369)	(0.0009919)	(0.0005574)	(0.0011423)	(0.0007499)
_cons	1.628427***	-0.1267124***	0.0718493***	-0.2816271***	0.6599245***	0.0856085***	-0.0136236	0.1392706***	-0.2802906***
	(0.1765336)	(0.0371855)	(0.0099347)	(0.0570208)	(0.0581736)	(0.0194919)	(0.0203857)	(0.0193872)	(0.0326302)

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

Source: Authors' calculations

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[i] Conducted annually by the Agency for Statistics of BiH (ASBiH), the HBS is a repeated cross-sectional study with national representation. Unlike panel surveys, it does not track the same households over time. The HBS is implemented uniformly across Europe, with methodologies aligned by Eurostat. In BiH, it serves as the only source of comprehensive household-level data, capturing expenditure patterns, economic and sociodemographic variables, and population weights. This makes it indispensable for assessing the impact of tobacco expenditures on other household consumption.