HEALTH ECONOMICS AND POLICY ANALYSIS

INSTITUTUL ASPEN ROMÂNIA

JULY 2026

wiiw HEPA Research Study 20

The crowding-out effect of tobacco expenditures in Romania:

A comprehensive analysis of household resource allocation and socioeconomic implications

George Ștefan, Milena Zaharia, Anca Maria Paraschiv and Marius Geantă

The Vienna Institute for International Economic Studies
Wiener Institut für Internationale Wirtschaftsvergleiche

The crowding-out effect of tobacco expenditures in Romania:

A comprehensive analysis of household resource allocation and socioeconomic implications

GEORGE ȘTEFAN
MILENA ZAHARIA
ANCA MARIA PARASCHIV
MARIUS GEANTĂ

George Ștefan is Associate Professor at the University of Economic Studies, Bucharest. Milena Zaharia is Professor at the University of Economic Studies, Bucharest. Anca Maria Paraschiv is Lecturer at the University of Economic Studies, Bucharest. Marius Geantă is President and Co-founder of the Center for Innovation in Medicine, Bucharest.

This research was funded by the Vienna Institute for International Economic Studies (wiiw), which is a partner of the Bloomberg Philanthropies' Initiative to Reduce Tobacco Use. The views expressed herein do not necessarily reflect the views of wiiw or Bloomberg Philanthropies.

Abstract

This report examines how tobacco expenditure displaces other categories of household consumption in Romania, drawing on nationally representative microdata from the Household Budget Survey for the 2015-2023 period. Employing regression-adjusted OLS and instrumental-variable specifications, the study documents a significant crowding-out of essential expenditures. Conditional on income and demographic composition, tobacco-consuming households allocate significantly less of their budget to housing and utilities, health, household maintenance, clothing, leisure, education, and personal care. At the same time, they allocate significantly more of their budget to alcohol, transport, and information and communications technology (ICT) services. The positive association with alcohol expenditure is consistent with the well-documented complementarity between the two addictive goods. While food expenditure is not significantly lower among tobacco-consuming households overall, higher levels of tobacco consumption among smokers are associated with lower spending on food, indicating crowding out at the intensive margin. The crowding-out of housing and the crowding-in of alcohol are both particularly pronounced among low-income households, suggesting that the welfare costs of tobacco use fall most heavily on those least able to bear them. Set against an increase of approximately 40% in tobacco affordability between 2011 and 2024, the findings call for excise increases that outpace wage growth, the earmarking of incremental revenue for household health, and statutory monitoring of tobacco affordability.

Keywords: Crowding-out effect, tobacco consumption, household expenditure

JEL classification: I12, D12, H31, C33

CONTENTS

TABLES AND FIGURES

Executive summary

Tobacco consumption represents a significant constraint on household welfare and national economic development in Romania, with the heaviest burdens falling on the most vulnerable. At the national level – counting both smoking and non-smoking households – monthly tobacco expenditure averaged EUR 43 in 2023, equivalent to approximately 4.1% of total consumption expenditure. Smoking households allocate, on average, more than 10.5% of their total monthly consumption budget to tobacco products, and this figure rises to 16.2% for low-income households. These patterns reflect the combined effects of high smoking prevalence, relatively affordable tobacco prices in real terms, and the limited deterring effect of recent excise increases against a background of rapid income convergence.

This report examines how tobacco expenditure displaces other categories of household consumption in Romania, drawing on nationally representative microdata from the Household Budget Survey (HBS) for the 2015-2023 period. The empirical analysis employs two complementary estimation frameworks: (i) a regression-adjusted budget-share comparison, in which the conditional difference between tobacco-consuming and non-consuming households is estimated by ordinary least squares (OLS) while controlling for household demographics, income level, region, and survey year; and (ii) an instrumental-variable specification, which addresses the endogeneity of tobacco expenditure and thereby enables causal identification of the expenditure effects.

The results document four substantive patterns of crowding-out and complementarity in Romanian household budgets. First, tobacco-consuming households allocate significantly less of their budget to housing and utilities, health care, household maintenance, clothing, leisure, education, and personal care than comparable non-consuming households. Second, they allocate substantially more to alcohol, transport, and information and communications technology (ICT) services, in what represents a crowding-in effect. Third, the crowding-out of housing and the complementarity with alcohol both exhibit clean monotonic regressive gradients across the income distribution: the housing displacement is 0.84 percentage points (pp) among low-income smoking households and only 0.33 pp among high-income ones, while the alcohol complementarity is 1.51 pp among low-income smokers and only 0.33 pp among high-income ones. Similar regressive patterns are found for the crowding-out of healthcare expenditures. Fourth, regarding the food-category, the Romanian data shows that smoking households do not allocate less to food than non-smoking households once income composition is controlled for; rather, food displacement is an intensive-margin phenomenon that occurs within the population of smoking households as a function of the volume of tobacco consumption.

Notably, the HBS data reveal a reversed gradient in smoking prevalence in Romania, whereby households in the top income tercile are more likely to report tobacco expenditures than those in the bottom tercile. Although this pattern contrasts with what is observed in most high-income countries, it is nevertheless consistent with statistics showing higher smoking prevalence among more educated groups in Romania. Nevertheless, the welfare burden of tobacco consumption falls disproportionately on poorer households, and earlier evidence (Nerău et al., 2024) suggests they are also more responsive to price increases.

These findings carry direct implications for the design of Romanian tobacco control policy, particularly in light of the increasing affordability of tobacco products. Between 2011 and 2024, the affordability of cigarettes increased by approximately 40%, with the share of GDP per capita required to purchase 100 packs of cigarettes falling from 3.84% to 2.75%, a trend that directly contradicts the affordability-reduction objectives of the WHO Framework Convention on Tobacco Control.

Four principal policy recommendations emerge from the analysis. First, Romania should raise tobacco excise faster than nominal wages (i.e. by at least 10 pp per year) for the 2026-2028 period. Second, a defined share of the incremental tobacco-tax revenues should be earmarked for a Household Health Security Fund, financing cessation services and early-detection screening for low- and middle-income households, which bear the largest budget displacement documented in this study. Third, a statutory affordability-monitoring mechanism with automatic corrective triggers should be established to prevent further erosion of the real price of tobacco against rising household incomes. Fourth, dedicated excise-impact simulation capacity should be developed at the National Agency for Fiscal Administration and the Ministry of Finance, drawing on TETSiM and equivalent international toolkits.

1. Introduction

This study investigates the displacement of non-tobacco household consumption induced by tobacco expenditure in Romania, building on the methodological framework set out in the Tobacconomics Updated Toolkit (John et al., 2023) as well as recent applications of that framework to other economies in Eastern and Southeastern Europe – notably Vladisavljević et al. (2024) on Serbia, Cizmovic et al. (2022) on Montenegro, and Merkaj et al. (2025) on Albania. The analysis exploits the microdata for the 2015-2023 period of the Romanian Household Budget Survey (HBS), a nationally representative annual survey conducted by the National Institute of Statistics that captures monthly expenditure across COICOP consumption categories[1] together with detailed household demographic characteristics, regional location, educational attainment, and household income. The final analytical sample contains 272,701 household-year observations, providing substantial statistical power for the detection of crowding-out effects across the income distribution and across heterogeneous demographic subgroups.

The crowding-out effect refers to the displacement of expenditure on essential goods and services by expenditure on non-essential or harmful consumption. In the case of tobacco, the mechanism operates through several channels. First, given finite household resources, tobacco expenditure directly reduces the budget available for other consumption, with the strength of the effect depending on the income elasticity of tobacco demand and the addictive character of tobacco consumption. Second, nicotine addiction may alter household consumption preferences in ways that produce systematic underinvestment in health, education, and other welfare-enhancing categories, with the distortion concentrated among lower-income households, for whom tobacco expenditure represents a larger proportion of total consumption. Third, when tobacco consumption exhibits the addiction characteristics formalised by Becker and Murphy (1988) – namely, tolerance, withdrawal costs, and reinforcement – households may maintain or increase tobacco expenditure even when income falls, forcing the budget adjustment to operate through other consumption categories (Chaloupka and Warner, 2000).

Empirically, the magnitude and direction of crowding-out effects depend on the income elasticity of tobacco demand relative to other goods, on the degree of addiction or habit formation, on household budget constraints and the available margins for adjustment, and on the substitutability or complementarity between tobacco and other consumption categories.

A growing body of international evidence demonstrates consistent patterns of food, education, housing, and health displacement across diverse economic contexts, with the magnitude of the displacement varying with income levels, tobacco prices, and the characteristics of the social protection system (John, 2008; Do and Bautista, 2015; Wisana et al., 2022; Masa-Ud et al., 2020; Merkaj et al., 2025; San and Chaloupka, 2016). The literature has documented, in particular, that tobacco use in low- and middle-income countries is associated with measurable reductions in household spending on education and health (Do and Bautista, 2015; Sreeramareddy et al., 2018; Özmen, 2023; Gamtessa and Guliani, 2023; Chisha, 2025), with the resulting implications for human capital formation and the persistence of poverty across generations. For example, Do and Bautista (2015) conducted a comprehensive multilevel

[1] Classification of Individual Consumption According to Purpose (United Nations 2018).

analysis using World Health Survey data from 53,625 adult males across 40 low- and middle-income countries, demonstrating that daily tobacco use is associated with an 8.0% decrease in household expenditures on education and a 5.5% decrease in spending on health care.

Several studies have observed a particular pattern in which the food-expenditure share of tobacco-using households remains stable or even increases relative to non-using households in unconditional comparisons, but with potential crowding-out of nutritionally rich foods rather than of the total quantity of food (Xin et al., 2009; Merkaj et al., 2025). This pattern is extremely relevant to Romania, where households allocate the highest share of their consumption budget to food and non-alcoholic beverages within the European Union (EU) – approximately 25% of the total in 2022, according to Eurostat (2026a) – and where any further compression of nutritional adequacy through tobacco-related crowding-out would carry serious welfare implications.

This paper is organised into six substantive sections. Section 2 sets out the macroeconomic and fiscal context for the analysis, including the recent evolution of tobacco affordability in Romania over the 2011-2024 period. Section 3 sets out the methodological framework motivating the dual-framework architecture adopted in the paper and specifying the regression-adjusted and instrumental-variable estimation strategies applied to the data. Section 4 presents the consumption patterns descriptively, while Section 5 presents the empirical results for both aggregate estimates and the income-stratified primary-framework estimates, followed by a discussion of results and the limits of current analysis. Section 6 develops the policy recommendations. Additional descriptive statistics for the final sample, supplementary estimation, and diagnostic results for the instrumental-variable specifications are presented in the Appendix.

2. The Romanian context: economic and fiscal dimensions

2.1. MACROECONOMIC ENVIRONMENT

Romania's GDP per capita, adjusted for purchasing power parity, reached more than 80% of the EU average in 2024 (versus 74% in 2022), demonstrating sustained progress in income convergence despite mounting fiscal pressures. The convergence trajectory did, however, encounter significant headwinds in 2024 and 2025. According to the Eurostat database (Eurostat, 2026b), the full-year real GDP growth rate slowed to 0.9% in 2024 and to 0.7% in 2025, versus 2.3% in 2023, representing a marked deceleration from the robust growth patterns of the previous decade. The slowdown reflects both domestic fiscal imbalances and external uncertainties, including the imposition of US tariffs, elevated inflation, geopolitical tensions, and domestic political and fiscal volatility.

The consumer-price inflation increased to 9.7% in 2025 following the value-added tax (VAT) rate increase that took effect in August 2025, a figure well above the previous beginning-of-year forecast of 5% and the Romanian Central Bank's medium-term projection of 2.5% (NBR 2025), with a variation band of one percentage point (pp). The current inflation rate is significantly higher than that of most EU member states and is projected to remain close to 4% at the end of the fourth quarter of 2026. Current projections for real GDP growth are 1.1% in 2026 and 2.1% in 2027, according to European Commission forecasts published in November 2025 (European Commission, 2025: 144), though these projections remain subject to considerable uncertainty given the political context, fiscal policy implementation, and the trajectory of energy prices. The projected growth rates fall substantially below Romania's estimated potential of 3%-4% annually, highlighting the constraining effects of the current fiscal and external imbalances.

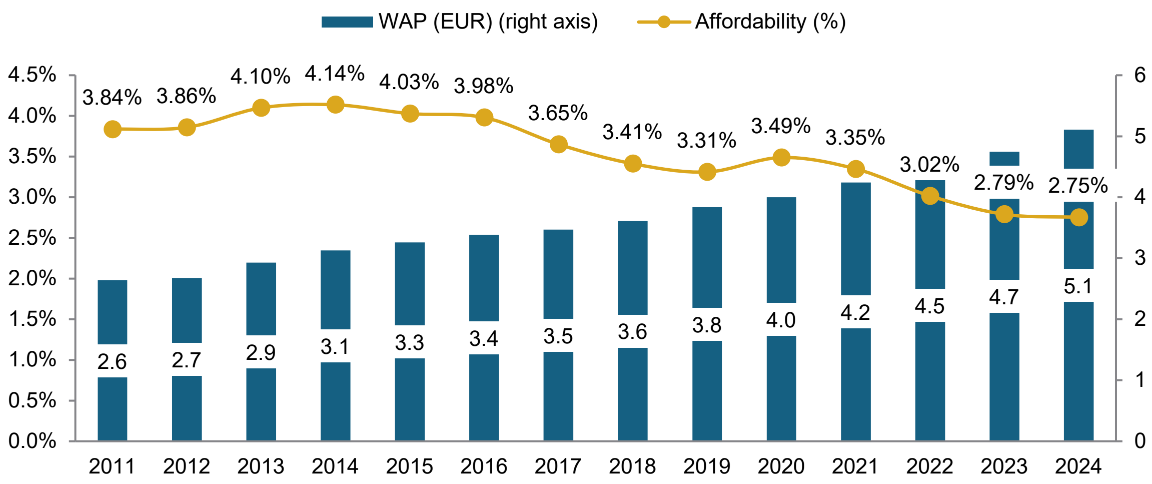
Romania's fiscal position has deteriorated dramatically, creating extraordinary pressures on household welfare and public service provision. The general government deficit reached 9.3% of GDP in 2024, fuelled by large increases in public-sector wages, interest payments, and pensions, representing one of the largest fiscal deficits in the EU and more than three times the EU's 3% reference value. The government has committed to a seven-year deficit-reduction plan targeting a fiscal shortfall of 7.7% in 2025 and falling to 2.5% by 2031, though recent performance suggests significant implementation challenges in the next several years. The fiscal crisis is expected to affect the household resource-allocation patterns analysed in this study through the channel of increased uncertainty about future public service provision and potential further tax adjustments even after the fiscal packages adopted in August 2025, which increased the standard VAT rate by 2 pp (from 19% to 21%) in order to lower the fiscal deficit.

The combination of continued inflation increases and modest wage growth in 2025 suggests that the relative affordability dynamics identified in earlier work (Aspen Institute Romania, 2025) may now be shifting, potentially altering the magnitude of the crowding-out effects estimated below. However, while the minimum gross wage in the Romanian economy increased to 4,050 Romanian lei (RON; approximately EUR 814) on 1 January 2025, reflecting continued efforts to maintain purchasing power amid inflationary pressures, real wage growth remains limited, primarily because of the government's fiscal-consolidation requirements and the slow growth prospects in the near and medium terms.

2.2. TOBACCO AFFORDABILITY

Over the 2011-2024 period, Romania experienced substantial economic growth, with GDP per capita in current prices rising from the equivalent of approximately EUR 6,000 to nearly EUR 19,000. This consistent upward trend in income levels, particularly after 2021, had direct implications for the affordability of tobacco products, measured here as the ratio of the weighted average price (WAP) of 100 packs of cigarettes to GDP per capita (see Figure 1). Despite planned excise increases through the Fiscal Code over the decade, tobacco products have become more affordable relative to household incomes. The WAP per pack increased from approximately RON 14.5 (EUR 3.26) in 2015 to RON 25.4 (EUR 5.11) by 2024, while both average GDP per capita and median household incomes grew at a faster pace amid an expansionary fiscal policy and expanding domestic aggregate demand.

Figure 1 / Affordability and weighted average price (WAP) per pack of cigarettes, 2011-2024



Source: Authors' calculation based on Eurostat (2026c) and Romanian Ministry of Finance data.

At the beginning of the period (between 2011 and 2014), against the background of the post-crisis fiscal-adjustment measures, affordability slightly declined despite rising GDP per capita, a trend likely driven by tobacco tax increases that momentarily outpaced income growth. Between 2014 and 2016, affordability stabilised, suggesting that the real-price deterrent effect of excise taxation was offset by improving household purchasing power. Between 2017 and 2019, affordability began to increase more markedly; nominal incomes continued to rise while excise taxes on tobacco were adjusted at a slower rate, contributing to a weakening of tobacco control through the price mechanism. In 2020, the COVID-19 pandemic produced a brief correction in which both affordability and GDP per capita registered modest declines. Beginning in 2021, Romania entered a post-pandemic phase of economic expansion in which GDP per capita (in current prices) rose sharply and affordability increased significantly, as well. By the end of 2024, only 2.75% of GDP per capita was required to purchase 100 packs of cigarettes, against 3.35% in 2021, indicating a relative cheapening of cigarettes against household incomes.

The pattern documented above suggests that the current excise taxation regime in Romania has not been calibrated to the dynamics of income convergence within the EU context. A static or below-inflation adjustment of excise rates is insufficient in a rapidly growing economy, as tobacco products become increasingly affordable – thereby neutralising past progress on consumption reduction – without regular above-inflation tax adjustments explicitly tied to wage or GDP growth. Romania's failure to maintain tobacco taxation ahead of income growth represents a missed opportunity for public-health improvement and underscores the inadequacy of inflation-only indexation in rapidly growing economies. The available evidence indicates that, as of 2024, the affordability of tobacco products in Romania has increased by approximately 40% relative to the 2011 baseline. This trend not only contradicts the affordability-reduction targets of the WHO Framework Convention on Tobacco Control (WHO 2003) but also implies a regressive public-health outcome in which increased consumption risks are concentrated among price-sensitive and low-income populations.

3. Methodology

This section sets out the econometric framework used to estimate the crowding-out effect of tobacco expenditures on other household consumption categories in Romania. The analysis rests on two complementary estimation strategies: (i) a regression-adjusted comparison of household budget shares between tobacco-consuming and non-consuming households, presented as the primary analytical framework, and (ii) a seemingly-unrelated-regression instrumental-variable (IV) specification following the methodology of John (2008) and Vladisavljević et al. (2024). The latter is presented as a secondary framework whose principal role is to corroborate the direction and statistical significance of the descriptive findings for those categories in which instrumental-variable identification is credible.

3.1. THE ECONOMETRIC SPECIFICATION

Regression-adjusted specification

The primary estimation strategy is a regression-adjusted comparison of budget shares between smoking and non-smoking households. For each of the 13 non-tobacco COICOP consumption categories indexed by *i*, the budget share w_i is regressed on households' smoking status d, log non-tobacco expenditure $ln\ M$, its square $(ln\ M)^2$, and a vector h of demographic controls comprising urban residence, household size, maximum household education, activity status, year-fixed effects, and county-fixed effects:

$$w_i = \alpha_{0,\mathrm{i}} + \alpha_{1,\mathrm{i}} * d + \alpha_{2,i} * lnM + \alpha_{3,i} * (lnM)^2 + \delta_i^{'} h + u_i \qquad (3.1)$$

The coefficient $\alpha_{1,\mathrm{i}}$ captures the conditional difference in the budget share for category *i* between smoking and non-smoking households, holding household income and the full demographic vector constant. The interpretation is non-causal: $\alpha_{1,\mathrm{i}}$ measures a conditional association, not a behavioural effect, since the smoking decision itself is endogenous to household preferences. No *d*-interactions on lnM or $(ln\ M)^2$ are included in this specification, so the Engel curve is constrained to have the same slope and curvature for smoking and non-smoking households, with smoking-household status entering only through the level shift $\alpha_{1,\mathrm{i}}$. The regression-adjusted estimates of $\alpha_{1,\mathrm{i}}$ across the 13 consumption categories are reported in Table 3 in Section 5.1.

This framework is estimated under household sampling weights (*coefj*) from Romania's National Institute of Statistics (NIS), which preserves national representativeness and aligns the descriptive interpretation of the coefficients with aggregate Romanian consumption patterns. The framework is estimated separately on the full sample and on three subsamples corresponding to terciles of per-adult-equivalent household income, with the equivalence scale following the OECD-modified convention: one unit for the first adult, 0.5 units for each additional adult, and 0.3 units for each child under 15 years of age. Terciles are computed year-specifically, ensuring that changes in the real income distribution across the nine survey years do not confound the income stratification.

Instrumental-variable specification

As mentioned above, while ordinary least squares (OLS) provides useful associations, it cannot definitively establish a causal effect because tobacco expenditure is endogenous to household preferences. To address this, we employ an IV specification following the standard methodology in the literature (John, 2008; John et al., 2023; Vladisavljević et al., 2024). In this framework, tobacco expenditure is treated as an endogenous regressor and instrumented with variables that are correlated with smoking behaviour but uncorrelated with the residual determinants of other budget shares.

More specifically, the IV specification adds tobacco expenditure pq as an additional regressor and permits the entire shape of the Engel curve – its level, its slope on log expenditure, and its curvature – to differ between smoking and non-smoking households through full *d*-interactions:

$$w_i = \beta_{0,i} + \beta_{0d,i}d + \beta_{1,i}pq + \left(\beta_{2,i} + \beta_{2d,i}d\right)lnM + \left(\beta_{3,i} + \beta_{3d,i}d\right)(lnM)^2 + \gamma_i^{'}h + \varepsilon_i \qquad (3.2)$$

The coefficient $\beta_{1,\mathrm{i}}$ represents the partial association between within-smoker tobacco expenditure and the budget share for category *i*. The *d*-interactions on lnM and $(lnM)^2$ are formally motivated by Wald tests on the joint null $\beta_0 d,_{\mathrm{i}} = \beta_2 d,_{\mathrm{i}} = \beta_3 d,_{\mathrm{i}} = 0$, which is rejected at the 1% significance level for nine of the 13 consumption categories; imposing the absence of smoker-specific Engel-curve parameters would therefore impose a substantively false restriction across the majority of the budget. The error term ε_{i} is assumed to be uncorrelated with the demographic controls and the within-county component of the regressors, with cluster-robust variance estimated at the county level (47 clusters: 41 counties plus 6 districts of Bucharest).

As mentioned earlier, tobacco expenditure pq is treated as endogenous and instrumented by a per-equation pair selected from the pool of demographic and leave-one-out (loo) cell-mean instruments, motivated by the methodology of Vladisavljević et al. (2024). The instrument for lnM and $(lnM)^2$ is redefined as the logarithm of total household expenditure, including tobacco $(lnTotal)$ and its square, rather than the logarithm of household income. The correlation of $lnTotal$ with lnM in the Romanian HBS is 0.9951, matching closely the 0.99 figure reported for Serbian data, and the first-stage partial R-squared for *lnM* under this instrument exceeds 0.98 in all specifications. This reassignment releases the remaining instruments to focus exclusively on the identification of pq.

At the same time, the choice of instruments for pq is made on a per-equation basis from a candidate pool comprising six elements:

› the adult sex ratio (male_ratio),

› the adult ratio in the household (adult_ratio),

› the leave-one-out mean of tobacco expenditure in the household's county-by-year cell (pq_loo_cy),

› the leave-one-out mean of tobacco expenditure in the finer county-by-year-by-activity cell (pq_loo_cyact),

› the leave-one-out smoking-prevalence rate in the county-by-year cell (d_loo_cy), and

› the leave-one-out smoking-prevalence rate in the county-by-year-by-activity cell (d_loo_cyact).

The leave-one-out construction excludes the index household's own contribution from its cell mean and provides instruments whose exogeneity derives from aggregation in the manner of Deaton (1997), and the further stratification by activity category follows directly the Vladisavljević et al. (2024) practice of capturing the socio-demographic profile of the smoker at finer granularity. For each of the 13 equations, the IV pair selected is the strongest (by partial R-squared) among those that do not reject Hansen's J overidentification test at the 10% significance level. Applying this selection rule to Romanian data yields the pairings reported in Table 4 in Section 5.2 and produces credibly identified coefficients for five of the 13 equations (i.e. food, clothing, education, HORECA, and personal care) together with two further equations (i.e. housing and alcohol) that satisfy both conditions marginally and are reported alongside the five.

For the remaining six equations, no pair in our candidate pool achieves the combination of adequate first-stage strength and non-rejection of Hansen's J. The IV specification results for these six categories are presented in the full diagnostic table in Annex 2 (Table A2.2) but are not used in the interpretation of the main text.

However, the limitation is that even in the cleanly identified equations, the absolute magnitudes of the IV coefficients, taken literally, imply in some cases large proportional displacement effects. This inflation reflects residual, small-magnitude impairments of the exclusion restriction that Hansen's J is insufficiently powered to detect when the two instruments in a pair share a common direction of violation. The IV specification results are accordingly reported for their direction and statistical significance, not for their absolute monetary magnitudes, while the substantive economic interpretation of the findings rests on the regression-adjusted specification.

3.2. SAMPLE CONSTRUCTION AND VARIABLE DEFINITIONS

The analytic sample is constructed from the Romanian HBS microdata provided by the National Institute of Statistics (NIS) for the 2015-2023 period. The raw file contains 273,185 household observations. Following the sample-construction convention of the Tobacconomics Toolkit (John et al., 2023), observations are excluded if they satisfy any of four conditions:

› total monthly expenditure is zero or missing (three observations);

› total monthly income is zero or missing (395 observations);

› the household head's education level is missing (85 observations);

› non-tobacco expenditure is zero or negative (one observation).

The resulting analytic sample contains 272,701 observations, corresponding to 94,670 tobacco-consuming households and 178,031 non-consuming households, or a raw smoking prevalence of 34.7% at the household level. After additional construction of leave-one-out instruments, which requires non-singleton cells for the relevant stratification, the sample used in the IV specification contains 272,673 observations.[2]

[2] The IV specification operates on 272,673 of the 272,701 observations; the small discrepancy of 28 observations arises exclusively from singleton county-by-year-by-activity cells, which are dropped from the first-stage estimation when computing the leave-one-out cell-mean instruments, and does not affect the comparability of the two specifications' estimates.

Tobacco expenditure pq is measured in current Romanian lei (RON) per month and combines monthly outlays on manufactured cigarettes, roll-your-own (RYO) tobacco, and other tobacco products. Non-tobacco expenditure M is constructed as total monthly household expenditure minus pq. The 13 non-tobacco consumption categories correspond to the COICOP two-digit aggregates for Romania, with alcohol and tobacco separately identified within the COICOP Division 02, as permitted by the granularity of the HBS microdata. Budget shares w_i are calculated as category-specific expenditure divided by M. The sampling weight *coefj* is applied in all descriptive analyses and the primary framework but not in the instrumental-variable specifications, consistent with the practice of Vladisavljević et al. (2024) and Solon et al. (2015) on weighted IV.

4. Descriptive analysis of household consumption

4.1. NATIONAL AGGREGATE CONSUMPTION PATTERNS: TRENDS AND THE SHARE OF SMOKING HOUSEHOLDS

Romania's household expenditure patterns in the 2015-2023 period show that, on average, Romanian households allocated approximately 25% of their total expenditure to food and non-alcoholic beverages – the highest share in the European Union, against an EU average of approximately 14% (Eurostat, 2026d). The food share has fallen from 31% in 2015 to 25% in the most recent years, as nominal household budgets have grown faster than nominal food prices, narrowing but not closing the gap with EU peers. The persistently high food-share level indicates constrained household budgets in which discretionary spending faces severe limitations and households operate closer to subsistence levels than their European counterparts, making them particularly vulnerable to the crowding-out effects of non-essential expenditures, such as on tobacco products.

Focusing on tobacco products, approximately 39%-40% of Romanian households engage in tobacco consumption, with the share rising from 34% in 2015 to a peak of 42% in 2020 and stabilising around 40% in most recent years. At the national level – counting both smoking and non-smoking households – the share of tobacco in total consumption averages 4.1%, with a declining trajectory, from 4.2% in 2015 to 3.8% in 2023 (Table 1).

On average, the data shows that monthly tobacco expenditures in nominal terms increased from RON 187 in 2021 to RON 214 in 2023 (see Table 1). At the same time, tobacco expenditures in real terms (national currency, deflated) decreased by approximately 3% over the same period because the annual consumer price index was significantly above the nominal growth rate of tobacco expenditures. In 2023, the average monthly household tobacco expenditure exceeded household spending on education, insurance and financial services, and ICT, and it consistently exceeded spending on alcoholic beverages, which typically receives similar policy attention from public-health and fiscal authorities.

The descriptive statistics by income group reveal clear consumption disparities across Romanian households between 2015 and 2023. Higher-income households consistently allocate larger absolute amounts of expenditure across all 14 COICOP categories, with the gap between the bottom and top terciles ranging from approximately twofold for food and housing to more than fourteenfold for hotels (i.e. accommodation services), restaurants, and cafés (HORECA). Lower-income groups exhibit a higher relative concentration of spending on essential goods: the share of the household budget allocated to food and non-alcoholic beverages is 37.7% in the bottom tercile compared to 16.9% in the top, a more than twofold compression that is the strongest income-elasticity effect documented in the data and indicates a limited capacity for discretionary consumption among low-income households. At the same time, higher-income households exhibit larger absolute dispersion (standard deviations) of expenditure across most categories, reflecting greater heterogeneity in absolute consumption levels at higher incomes. In relative terms, however, the coefficient of variation tends to fall with income for most categories, as the share of households with zero or near-zero expenditure on luxury and semi-discretionary categories declines moving up the income distribution (see Table A1.4 in Annex 1 for details).

Table 1 / Mean monthly household consumption expenditure in Romania by COICOP category, 2015-2023 (RON, weighted)

COICOP category	2015	2016	2017	2018	2019	2020	2021	2022	2023
Food and non-alcoholic beverages	513	528	578	639	690	713	791	944	1,075
Alcoholic beverages	20	21	24	27	29	31	37	41	44
Tobacco	94	104	123	140	154	173	187	200	214
Clothing and footwear	97	117	145	168	203	160	195	212	238
Housing, water, electricity, gas, fuels	296	307	329	350	375	393	440	542	553
Furnishings, household equipment, maintenance	81	98	133	149	176	181	207	223	255
Health	83	87	99	113	125	129	156	167	206
Transport	106	110	135	164	178	170	206	251	277
Information and communication	91	101	110	119	127	145	146	148	152
Recreation, sport, culture	51	57	57	64	68	51	59	71	83
Education	5	4	4	5	5	4	5	5	7
HORECA	36	44	56	78	86	47	72	94	114
Insurance and financial services	10	13	13	14	15	17	20	23	28
Personal care and miscellaneous	16	21	27	32	37	36	45	56	68
TOTAL CONSUMPTION EXPENDITURE	**2,062**	**2,251**	**2,594**	**3,396**	**3,816**	**4,055**	**4,573**	**5,233**	**5,812**
Tobacco as % of total expenditure	**4.56%**	**4.62%**	**4.74%**	**4.12%**	**4.04%**	**4.27%**	**4.09%**	**3.82%**	**3.68%**

Notes: The tobacco expenditures correspond to manufactured cigarettes, roll-your-own (RYO) tobacco, and other tobacco products combined. Total consumption expenditure includes both monetary and non-monetary expenditure (the latter comprising principally imputed rent for owner-occupied housing and the imputed value of self-produced food). The sum of the 14 COICOP categories does not equal the total because the categories only cover the monetary expenditure component; the difference represents non-monetary consumption (approximately 32% of total expenditure on average across the period). N = 272,701 household-year observations.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata, under NIS sampling weights.

An important descriptive observation concerns the share of households classified as smoking in each income tercile. When household income is measured on a per-adult-equivalent basis using the OECD-modified equivalence scale, the survey-weighted share of households with positive tobacco expenditure is 22.6% in the bottom tercile, 36.9% in the middle, and 53.5% in the top (see Table A1.1 in Annex 1). These values registered for Romania are the opposite of what is found in the international literature on smoking prevalence, which consistently identifies higher smoking rates among lower-income populations.

The reversed gradient in HBS-based tobacco status – under which smoking prevalence rises rather than falls with income – could reflect several mechanisms. The first is due to the NIS sample itself, as the Romanian HBS classifies a household as a smoking household if any member reports positive tobacco expenditure, and larger households have a higher probability of containing at least one smoker even under random smoking. The second mechanism is the Romanian-specific finding documented in the European Health Interview Survey (EHIS) in 2019, which shows that smoking prevalence is higher among the more educated, unlike the typical EU pattern of declining prevalence with education. Since education and income correlate positively, this pattern is consistent with higher smoking prevalence in upper income terciles. The third mechanism concerns potential sampling bias in the HBS, which may underrepresent both the lowest- and highest-income households, who are less likely to participate in consumer surveys and may have above-average smoking prevalence. Finally, low-income groups tend to participate more in the informal tobacco market – including purchases of contraband/counterfeit cigarettes or the use of self-cultivated tobacco – which may result in an underestimation of smoking prevalence among poorer households in the HBS.

4.2. CONSUMPTION STRUCTURE AMONG SMOKING AND NON-SMOKING HOUSEHOLDS, 2015-2023

In nominal terms, the average monthly consumption expenditure of non-smoking households over the 2015-2023 period was approximately RON 3,091, while for smoking households the corresponding total was RON 4,786 (see Table A1.6 in Annex 1). The 1.55 ratio of smoker-to-non-smoker total expenditure has been remarkably stable across the nine survey years, varying within a narrow range of 1.48 to 1.57 (see Table A1.3 in Annex 1). This persistent gap reflects the joint action of two factors: the higher labour-force participation of smoking households (which increases earned income) and the differential demographic composition of the two groups, with smoking households being, on average, larger, more urban, and concentrated in the upper segments of the income distribution.

Across the period, Romanian non-smoking households allocated significantly higher shares of their expenditure than smoking households to several categories that bear directly on long-term household welfare (see Table 2 below). The gap is largest for food and non-alcoholic beverages, where non-smoking households allocated 29.3% of total expenditure compared to 21.1% for smoking households (an 8.2-pp gap); for housing, water, electricity, gas, and fuels, where non-smokers allocated 16.7% compared to 11.2% for smokers (5.5 pp); for health, where non-smokers allocated 6.2% compared to 3.0% for smokers (3.2 pp); and for furniture, equipment, and household maintenance (1.3 pp). Smoking households, by contrast, allocated marginally higher shares than non-smoking households to transport (4.2% compared to 3.5%, a 0.7-pp gap), to alcohol (1.2% compared to 0.8%, a 0.4-pp gap), and to HORECA (1.3% compared to 1.0%, a 0.4-pp gap). Education spending was small and indistinguishable between groups (0.08% in each).

On average, smoking households allocated approximately 10.5% of their total consumption expenditure to tobacco itself across the 2015-2023 period, representing a substantial opportunity cost relative to the categories of essential consumption discussed below. In 2015, the tobacco share among smoking households was 12.2%; by 2023, it had fallen to 9.3%, a decline of nearly three pp. Over the same nine-year period, average monthly tobacco expenditure in nominal terms rose from RON 276 to RON 531, an increase of 92%, while average total household expenditure among smokers rose from RON 2,674 to RON 7,215, an increase of 170% (see Table A1.2 in the Annex). The compression of the tobacco share is therefore not the consequence of declining smoking intensity (which the Romania data of the Global Adult Tobacco Survey[3] and the implicit volume calculations in the HBS both rule out) but rather of nominal household budgets growing substantially faster than nominal tobacco prices, which is the household-budget footprint of the affordability increase documented in Section 2.2.

However, it is necessary to interpret the differences with nuances. The gaps in budget shares between smoking and non-smoking households conflate two distinct mechanisms: (i) a composition effect reflecting the fact that smoking and non-smoking households differ in income, demographic structure,

3 WHO and Romanian Ministry of Health (2018).

and other characteristics that influence budget allocation, and (ii) a behavioural effect attributable to tobacco consumption itself. The econometric analysis in Section 5 separates these two mechanisms by conditioning on income level, household composition, and the full demographic control vector. Several of the unconditional differences described above are substantially attenuated once the conditional analysis is conducted (see Section 5 for details).

Table 2 / Average expenditure structure of smoking and non-smoking households, weighted budget shares in %, 2015-2023

Category	Non-smoker households	Smoker households	Difference (pp)
Food and non-alcoholic beverages	29.31	21.10	−8.21
Clothing and footwear	4.45	4.11	−0.33
Housing, water, electricity, gas, fuels	16.66	11.16	−5.50
Furniture, equipment, household maintenance	5.16	3.88	−1.28
Health	6.23	3.00	−3.23
Transport	3.51	4.19	+0.68
ICT	4.24	3.69	−0.55
Leisure, sport, culture	2.28	1.64	−0.64
Education	0.08	0.08	+0.00
HORECA	0.99	1.34	+0.35
Insurance and financial services	0.29	0.36	+0.07
Personal care and miscellaneous	0.92	0.80	−0.13
Alcoholic beverages	0.79	1.18	+0.39
Tobacco	0.00	10.47	+10.47
Non-monetary consumption and other non-classified items*	25.1	33	+7.9

Notes: NIS sampling weights (*coefj*) applied throughout. Sample N = 272,701 household-year observations (40.81 million weighted non-smoking households, 26.65 million weighted smoking households). Each entry reports the survey-weighted mean of the household-level budget share, computed as category expenditure divided by total monthly consumption expenditure.
* Non-monetary consumption and non-classified items include imputed rent for owner-occupied housing (representing its largest share), the imputed value of self-produced food, and other non-classified cash items.
Source: Authors' calculations on Romanian HBS 2015-2023 microdata (NIS).

Stratifying the descriptive comparison by per-adult-equivalent income tercile improves the picture. Among low-income households, smoking households allocate 16.2% of total expenditure to tobacco, compared to 11.8% in the middle tercile and 8.0% in the top tercile (see Table A1.5 in Annex 1). The compression of the tobacco share with rising income is the standard pattern observed in every comparator-country study (Vladisavljević et al., 2024, on Serbia; Cizmovic et al., 2022, on Montenegro; Merkaj et al., 2025, on Albania) and reflects the fact that absolute tobacco expenditure does not scale proportionally with household income.

The same income gradient operates on essential categories in a related but distinct manner. For food, the smoker-to-non-smoker share gap is 6.7 pp in the low tercile (39.3% versus 32.6%), 5.0 pp in the middle (29.1% versus 24.1%), and 1.8 pp in the top (17.8% versus 16.1%), with the absolute level of the food share itself falling sharply with income for both groups in the standard income-effect pattern. For housing and utilities, the gap is 5.7 pp in the bottom tercile, 4.4 pp in the middle, and 1.7 pp in the top. For health, the gap is 3.8 pp in the bottom tercile, 3.4 pp in the middle, and 1.1 pp in the top.

5. Results of the econometric analysis

This section presents the estimation results of the specification described in Section 3. The discussion proceeds in four stages. Section 5.1 reports the aggregate results from the primary analytical framework, namely, the regression-adjusted budget-share differences between tobacco-consuming and non-consuming households (see Table 3). Section 5.2 presents the corresponding estimates from the IV framework, restricted to those categories for which instrumental-variable identification is reliable (see Table 4). Section 5.3 examines the heterogeneity of the primary-framework coefficients across income terciles (see Table 5). Lastly, Section 5.4 discusses the similarities and frictions between the two frameworks' estimates and draws conclusions about the nature of tobacco-related crowding-out in Romanian household budgets.

5.1. AGGREGATE RESULTS FROM THE REGRESSION-ADJUSTED FRAMEWORK

Table 3 reports the coefficient estimates on the tobacco-status indicator *d* from the regression-adjusted specification (Equation 3.1) for each of the 13 non-tobacco consumption categories. Coefficients are expressed in pp units, corresponding to the conditional difference in budget allocation between tobacco-consuming and non-consuming households at equal levels of non-tobacco expense, demographic composition, urban residence, education, activity status, year, and county. The entries are therefore directly interpretable as the fraction of the non-tobacco budget that smoking households reallocate away from – or towards – each category, conditional on holding the non-tobacco budget size and composition fixed.

The coefficients on housing and utilities, health, household maintenance, clothing, education, personal care, and leisure are statistically significant and negative, while those on alcohol, transport, and ICT are significant and positive. For food, the coefficient is positive and marginally significant at the 10% level, and for HORECA and financial services, it is statistically insignificant at conventional levels.

In Table 3, three coefficients deserve particular emphasis. The largest in proportional terms is on health: a 0.66-pp conditional difference between smoking and non-smoking households on a non-smoker baseline of approximately 4.5% represents a 14.7% relative compression of the health budget share – which is the single most policy-salient finding of the analysis as well as consistent with the international evidence on tobacco-related crowding-out of essential consumption. The largest in absolute terms is on housing and utilities, at 0.77 pp, which, on a non-smoker baseline of approximately 9%, represents an 8.6% relative compression. The third large coefficient is on alcohol, with tobacco-consuming households allocating 0.72 pp more of their non-tobacco budget to alcohol than otherwise-comparable non-consuming households; this is a sign of complementarity between tobacco and alcohol consumption that the international literature consistently identifies.

Table 3 / Regression-adjusted budget-share differences between tobacco-consuming and non-consuming households, aggregate sample

Category	Coefficient (pp)	Standard error	t-statistic	p-value
Food	+0.337	0.197	+1.71	0.087 *
Clothing and footwear	−0.251	0.101	−2.49	0.013 **
Housing and utilities	−0.765	0.134	−5.72	0.000 ***
Household maintenance	−0.347	0.102	−3.42	0.000 ***
Health	−0.659	0.098	−6.72	0.000 ***
Transport	+0.395	0.082	+4.83	0.000 ***
ICT and communications	+0.249	0.052	+4.79	0.000 ***
Leisure and culture	−0.124	0.036	−3.45	0.000 ***
Education	−0.028	0.009	−3.12	0.002 ***
HORECA	+0.058	0.072	+0.81	0.419
Financial services	+0.031	0.020	+1.52	0.128
Personal care	−0.074	0.032	−2.32	0.020 **
Alcohol	+0.719	0.041	+17.65	0.000 ***

Notes: Each row reports the estimated coefficient on the tobacco-status indicator *d* from a separate regression of the named category's budget share on *d*, *lnM*, $(lnM)^2$, urban, household size, education-level fixed effects, activity-status-fixed effects, year-fixed effects, and county-fixed effects. N = 272,701. NIS sampling weights applied. Cluster-robust standard errors at the county level (47 clusters). Coefficients are expressed in pp units (i.e. the raw coefficient multiplied by 100). Significance level: *** ($p < 0.01$), ** ($p < 0.05$), * ($p < 0.10$).
Source: Authors' calculations.

The positive sign on the food coefficient is a considerable departure from some of the comparator-country literature. The unconditional mean food share is approximately 5.3 pp higher among non-consuming households than among consuming households, but essentially the whole of this raw gap is explained by composition: tobacco-consuming households are on average wealthier at equal household size, and wealthier households allocate a smaller share of their budget to food. Once income composition is held constant, smoking households allocate a marginally higher share of their budget to food than non-smoking households do. The finding does not contradict the existence of an intensive-margin food-displacement effect; as Table 4 in Section 5.2 below shows, the IV specification estimates indicate that higher tobacco expenditure is associated with a lower food share among tobacco-consuming households.

5.2. AGGREGATE RESULTS FROM THE IV SPECIFICATION

Table 4 reports the coefficient on tobacco expenditure pq when estimating Equation 3.2 for the seven categories in which credible instrumental-variable identification could be established. The table reports the IV pair selected per equation, the raw 2SLS coefficient with cluster-robust standard error in parentheses, the z-statistic, the p-value, the first-stage Kleibergen-Paap partial R-squared for the identification of pq, the corresponding first-stage F-statistic, and the Hansen J p-value for the overidentification test of the exclusion restriction.

The IV specification estimates corroborate the direction of the primary-framework findings for the categories in which they can be meaningfully identified. Food, clothing, education, HORECA, and personal care all display negative and, in four of five cases, there are statistically significant coefficients on tobacco expenditure. The food coefficient under this methodological framework is negative, at

−0.000282 per RON of tobacco expenditure (p = 0.000); this sign appears to contradict the positive food coefficient of Table 3 but is better understood as a complementary finding.

The IV methodology identifies the intensive-margin effect of tobacco expenditure conditional on participation: the displacement of food expenditure operates among smokers as a function of how much they smoke, whereas the regression-adjusted specification identifies the extensive-margin difference between smokers and non-smokers in a non-causal, conditional-association sense. The common idea is that smoking households, viewed as a class, do not allocate less to food than non-smoking households once demographic composition is controlled for, but within the population of smoking households, higher tobacco expenditure is associated with a lower food budget share. This sharpens rather than overturns the international narrative on food displacement and has direct implications for the targeting of tobacco control measures on heavy users (as discussed in Section 6).

Importantly, as presented in Table 4, several diagnostic tests confirm the reliability of the results. First, the first-stage partial R-squared for pq in the cleanly identified equations ranges from 0.017 to 0.021, confirming that the per-equation Vladisavljević et al. (2024) selection materially strengthens identification. Second, tests for the validity of instruments (Hansen's J p-values above 0.23 in five of the seven equations) indicate that the null hypothesis is not rejected, and that the selected instruments are valid for those equations.

Table 4 / SUR-IV estimates of the coefficient on tobacco expenditure, for cleanly identified equations only

Category	IV pair for pq	Coef. / (SE)	z	P>|z|	pR²(pq)	F(KP)	Hansen J p
Food	male_ratio + pq_loo_cyact	−0.0002824*** *(0.0000631)*	−4.48	0.000	0.018	58.33	0.688
Clothing	pq_loo_cyact + d_loo_cyact	−0.0000612*** *(0.0000184)*	−3.33	0.001	0.021	43.36	0.753
Housing (H)	pq_loo_cyact + d_loo_cy	+0.0000322 *(0.0000577)*	+0.56	0.576	0.017	26.54	0.128
Education	male_ratio + pq_loo_cyact	−0.0000080*** *(0.0000027)*	−2.91	0.004	0.018	58.33	0.235
HORECA	adult_ratio + pq_loo_cyact	−0.0000529** *(0.0000251)*	−2.11	0.035	0.017	24.19	0.711
Personal care	pq_loo_cyact + d_loo_cyact	−0.0000125 *(0.0000077)*	−1.63	0.103	0.021	43.36	0.677
Alcohol (H)	pq_loo_cyact + d_loo_cy	+0.0000112 *(0.0000089)*	+1.27	0.205	0.017	26.54	0.305

Notes: Each row reports the estimated coefficient on pq from a separate 2SLS regression of the named category's budget share on *pq* (endogenous), lnM, and $(lnM)^2$ (endogenous), $d \times lnM$, $d \times (lnM)^2$, d, and the full demographic control vector and county fixed effects. N = 272,673. Instruments for *lnM* and (*lnM*)² are *lnTotal* and (*lnTotal*)² in all specifications. The IV pair for pq is selected per equation as described in Section 3.1; descriptions of the IV variables can be found in Section 3.1. Cluster-robust standard errors at the county level (47 clusters: 41 counties plus 6 districts in Bucharest), reported in parentheses. Significance: *** (p < 0.01), ** (p < 0.05), * (p < 0.10). (H) denotes equations in which the selected pair passes Hansen's J marginally. Results correspond to the *ivreg2* output reproduced in Annex 2.
Source: Authors' calculations.

When translating the IV-estimated coefficients to pp units, some of the estimated crowding-out effects appear relatively large at first. For example, at the mean tobacco expenditure among smoking households (RON 361.5 per month), the model suggests a 10-pp reduction in the food budget share. While this is a substantial shift, it remains within the realistic range of food spending observed in Romanian households (15%-40% of the budget). However, the translated magnitudes are accordingly best interpreted as upper-bound rather than precise per-RON estimates of the crowding-out elasticity. This caution is necessary because small-magnitude violations of the exclusion restriction that Hansen's J test cannot detect (e.g. when both instruments in a pair share a common direction of violation) may result in an upward bias.

5.3. HETEROGENEITY ACROSS INCOME TERCILES

To understand how tobacco consumption's impact changes with income, Table 5 breaks down the primary-framework coefficients presented in Table 3 according to the three income terciles. As with the aggregate results, these stratified coefficients represent conditional associations rather than direct causal effects. Nevertheless, the stratification permits an assessment of whether the crowding-out and complementarity effects documented in the aggregate sample are uniform across the income distribution or concentrated at particular points of it. The economic interest of this heterogeneity is that welfare costs of tobacco consumption usually fall disproportionately on low-income households, and the stratification provides the sharpest available test of this claim within the HBS data.

Table 5 / Regression-adjusted budget-share differences between tobacco-consuming and non-consuming households, by tercile of per-adult-equivalent household income

Category	Low income tercile	Middle income tercile	High income tercile
Food	+0.134	+0.496 **	+0.580 ***
Clothing and footwear	−0.238 *	−0.151	−0.261 **
Housing and utilities	**−0.837 *** **	**−0.490 *** **	**−0.325 *** **
Household maintenance	−0.126	−0.307 ***	−0.371 ***
Health	**−0.877 *** **	**−0.996 *** **	**−0.292 *** **
Transport	+0.217	+0.568 ***	+0.386 ***
ICT and communications	**+0.351 *** **	**+0.245 *** **	**+0.226 *** **
Leisure and culture	−0.125	−0.053	−0.118 ***
Education	−0.012	−0.022	−0.030 **
HORECA	+0.215 ***	+0.137 **	−0.023
Financial services	−0.055	+0.065 ***	+0.040
Personal care	−0.074	−0.048	−0.078 **
Alcohol	**+1.505 *** **	**+0.726 *** **	**+0.325 *** **

Notes: The estimated coefficient on the tobacco-status is the indicator *d* from a separate regression on the indicated income-tercile subsample, using the same specification as Table 3. Coefficients expressed in pp units. Income terciles computed year-specifically on per-adult-equivalent income using the OECD equivalence scale. N per tercile approximately 90,900.
Significance: *** ($p < 0.01$), ** ($p < 0.05$), * ($p < 0.10$).
Source: Authors' calculations.

Three patterns in Table 5 bear directly on the policy argument of this study. First, the coefficient on **housing and utilities** exhibits a strong regressive gradient: the conditional difference between smoking and non-smoking households is 0.84 pp in the bottom income tercile, 0.49 in the middle, and 0.33 in the top.

A regressive pattern – but in the opposite direction – is observed for **alcohol**, with a complementarity coefficient of 1.51 pp in the bottom tercile, 0.73 pp in the middle, and 0.33 pp in the top. Taken together, these two rows describe a substitution pattern in which low-income smoking households reallocate more from housing to other consumption categories like alcohol, with the reallocation attenuating as income rises. At the lower end of income distribution, the elasticity of substitution between tobacco-linked complementary goods and essential fixed expenditures is higher, and the budget constraint binds more tightly. The implications for the welfare cost of tobacco consumption are that the households least able to afford the displacement of housing expenditures are precisely those in which the displacement is largest.

Second, the **health** coefficient is concentrated in the bottom two terciles. The low-income tercile exhibits a coefficient of −0.88 pp, the middle −1.00 pp, and the top −0.29 pp. The attenuation at the top of the income distribution is consistent with a budget-constraint interpretation, in which affluent smoking households possess the income flexibility to absorb tobacco expenditure without compressing healthcare expenses, while low- and middle-income smoking households cannot.

Third, the **food** coefficient exhibits a positive gradient across income terciles, moving from statistically insignificant at the bottom to significantly positive at the middle (+0.50 pp) and top (+0.58 pp) of the income distribution. The positive sign reflects the fact that, once non-tobacco expenditure and demographic composition are held constant, the incremental budget share of smoking households allocated to food is marginally higher than for non-smoking households. The gradient indicates that this compositional pattern is stronger in the middle and upper parts of the income distribution. Nevertheless, the pattern should not be interpreted as evidence that tobacco expenditure expands food consumption; rather, it indicates that, at given income, the within-household reallocation from other categories towards tobacco leaves the food share approximately unchanged or marginally higher, while other categories (e.g. housing, health care, and household maintenance) bear the adjustment.

5.4. DISCUSSION OF RESULTS AND LIMITATIONS

A robustness check on these findings is to ask whether the primary and secondary frameworks agree on the direction and significance of the effects in the categories where both deliver estimates. Among the five categories with clean IV identification, three show clear agreement across the two frameworks: clothing, education and personal care. In all three cases, both frameworks produce negative coefficients. In the regression-adjusted framework, the effects are statistically significant throughout. In the IV model, the effects are also statistically significant for clothing and education, while personal care is only marginally significant.

This consistency is especially reassuring because the secondary framework relies on different instrument pairs, yet it yields the same coefficient signs and a broadly similar pattern of statistical significance.

The food and HORECA categories exhibit sign disagreement between the two frameworks. In both cases, this is best understood not as an inconsistency but as a substantive finding, namely, that the two frameworks are answering different questions: the extensive margin (smoker versus non-smoker) and the intensive margin (more versus less tobacco among smokers). The food finding is discussed in detail in Section 5.2 above. The HORECA finding parallels it: the primary framework detects no statistically significant difference in the extensive-margin HORECA share between smoking and non-smoking households, but the IV technique identifies a significant intensive-margin negative relationship between tobacco expenditure and HORECA share within the population of smoking households. Taken together, the cross-framework comparison supports the claims of the report at the categories of cleanest identification and clarifies the interpretation of the apparent disagreements as differences in estimand rather than as conflicts in evidence.

The six categories in which the IV specification fails to achieve clean identification (i.e. household maintenance, health, transport, ICT, leisure, and financial services) share a common economic characteristic: they are all consumption categories for which regional and socio-demographic variation in tobacco expenditure probably co-varies with regional and socio-demographic variation in the category directly through shared cultural, infrastructural, or institutional channels that no instrument constructed from HBS data can isolate on its own. For example, health expenditures in Romania are strongly regionally stratified by the quality of local primary-care infrastructure, transport expenditure by regional commuting patterns, and leisure and ICT expenditure by the urban-rural gradient in the availability of the services themselves. The leave-one-out tobacco-spending instruments used in the IV specification plausibly capture this same regional variation in lifestyle and infrastructure, rendering the exclusion restriction difficult to defend regardless of which specific instruments are chosen. The regression-adjusted methodology, which relies on conditional independence rather than exclusion, does not face this identification problem and, accordingly, delivers interpretable estimates for all 13 categories.

Taken as a whole, the findings of this study support four conclusions that are robust across both specifications. First, tobacco consumption is significantly associated – both statistically and economically – with the **crowding out of expenditure on housing, health, household maintenance, clothing, leisure, education, and personal care**. Second, tobacco consumption displays **strong complementarity with alcohol consumption** at every point of the income distribution. Among low-income smoking households, the alcohol budget share is approximately 2.5 times that of comparable non-smoking households, the largest single coefficient anywhere in the results matrix. Third, the **crowding-out of housing and the complementarity with alcohol both exhibit a clear regressive gradient across the income distribution**, with the largest effects concentrated in the bottom tercile. Fourth, **the displacement of food expenditure operates among smokers as a function of how much they smoke** (the intensive margin) rather than as a difference between smokers and non-smokers (the extensive margin). These findings inform the policy recommendations of Section 6, in which the case for intensive-margin-oriented tobacco control instruments is developed.

However, there are a number of limitations. The principal limitations of this study arise from the structural identification challenges in the IV technique and from the cross-sectional nature of the Romanian HBS microdata.

The validity of the regression-adjusted primary framework depends on the conditional-independence assumption (i.e. that, conditional on the demographic control vector, the assignment of households to tobacco-consuming status is as good as random with respect to the residual unobserved determinants of budget shares). This assumption is not directly testable with the present data, and any unobserved heterogeneity in consumption preferences correlated with the decision to smoke would bias the estimated coefficients in directions that the data themselves cannot reveal.

The instrumental-variable framework attempts to relax the conditional-independence assumption by exploiting variation in tobacco expenditure that is plausibly exogenous to non-tobacco budget shares. However, as discussed in Section 5.4, the available instruments are sufficient to deliver a clean identification in only seven of the 13 non-tobacco consumption categories. For the remaining six categories (i.e. household maintenance, health, transport, ICT, leisure, and financial services), no combination of instruments in the candidate pool produces both adequate first-stage strength and non-rejection of Hansen’s J overidentification test, and the substantive interpretation of these categories’ coefficients rests on the primary framework alone.

A second limitation concerns the measurement of tobacco consumption. As discussed in Section 4.2, the HBS-based household-level tobacco indicator only captures formal-market expenditure, and any tobacco consumption sourced from the informal market (i.e. through contraband/counterfeit/cross-border purchases or self-cultivation) does not enter the classification. The differential participation of low-income households in the informal market produces an HBS-based smoking-prevalence gradient (22.6% in the bottom income tercile compared to 53.5% in the top) that runs opposite to the international evidence on smoking prevalence by income, in which lower-income populations consistently exhibit higher prevalence rates.

The conditional crowding-out estimates of Section 5 are unaffected by this measurement issue in the sense that the analysis estimates the conditional difference in budget shares for households identified as tobacco-consuming in the HBS regardless of the correctness of the absolute prevalence levels, but the interpretation of the results in absolute prevalence terms is constrained accordingly. The integration of an auxiliary survey such as the Global Adult Tobacco Survey (GATS) or the WHO’s STEPwise approach (STEPS), in which tobacco consumption is captured through individual-level direct elicitation rather than through household expenditure, would in principle permit the construction of a corrected smoking-status indicator and the imputation of consumption to households whose HBS expenditure record does not reveal it.

A third limitation concerns the cross-sectional structure of the data. The HBS does not track individual households across years, and the analysis treats the nine waves as independent cross-sections pooled with year-fixed effects. This excludes the application of household-level fixed-effects estimators or matched difference-in-differences methods, which have been used successfully in recent crowding-out studies on countries with panel-data infrastructure (Chelwa and Koch, 2019; Nyagwachi et al., 2020). Constructing a Romanian household panel through the use of rolling-sample retention or through the linkage of HBS records to administrative records is a natural direction for future work and would permit the estimation of within-household crowding-out effects free from the unobserved-heterogeneity problem that constrains the present cross-sectional analysis.

A fourth limitation concerns the COICOP aggregation level. The 13 consumption categories used in this study correspond to the two-digit COICOP classification, but each category contains internal heterogeneity that the aggregation masks. Within food, in particular, the international literature has documented that tobacco-related crowding-out may displace nutritionally rich foods rather than total food quantity, with potentially serious implications for child nutritional outcomes. Although the intensive-margin food finding of the IV specification (Section 5.2) is consistent with this hypothesis, it cannot test it directly without the disaggregation of the food category into sub-components. Future work using the disaggregated HBS line-item data should pursue this question explicitly, given its first-order relevance for child welfare and human-capital formation in low-income smoking households.

6. Conclusions and recommendations

The Romanian case presented in this study demonstrates that tobacco consumption represents both a public-health challenge and a significant constraint on household welfare and economic development, with the welfare losses falling disproportionately on the lower segments of the income distribution. The empirical results show that tobacco-consuming households allocate significantly less of their budget to housing and utilities, health care, household maintenance, clothing, leisure, education, and personal care than comparable non-consuming households. These patterns display strong regressive gradients across the income distribution: the crowding-out of housing and health expenditures are concentrated among low-income households, which lack the income flexibility to absorb tobacco costs without spending less on categories consequential for long-term welfare and human-capital formation (e.g. housing, health care, and household maintenance). The displacement of food expenditure operates at the intensive margin within the population of smoking households rather than at the extensive margin between smokers and non-smokers, a finding that contributes to the international evidence and carries direct implications for the design of tobacco control instruments.

The findings on alcohol complementarity are also important to notice. Among low-income smoking households, the budget share allocated to alcohol is 1.51 pp higher than for otherwise-comparable non-consuming households, representing a doubling of the alcohol share. The strong complementarity effect[4] suggests that tobacco control instruments may produce welfare gains beyond their direct health effects by simultaneously reducing alcohol consumption among the most vulnerable.

Given the well-established health implications and the documented additional welfare costs of tobacco use, fiscal policy emerges as the most effective instrument to reduce tobacco consumption. The economic rationale for using excise taxes is further supported by the higher price sensitivity of low-income households, documented by Nerău et al. (2024) using Romanian HBS data. These findings suggest that tobacco tax increases would be highly progressive in terms of health and welfare. As the poorest households are the most price-sensitive, they are the most likely to quit or significantly reduce consumption in response to higher prices, thereby avoiding both the direct cost of tobacco and the disproportionate crowding-out of essential needs identified in this study. Additionally, the reversed gradient of smoking prevalence in Romania – where smoking is more prevalent among high-income households – presents a unique fiscal opportunity. Given that wealthier households smoke more and are significantly less price-sensitive, a tax increase is expected to result in relatively higher tax revenue, primarily collected from higher-income households more able to absorb the costs. Romania can thus utilise excise policy as a dual-purpose tool: a health intervention that protects the most vulnerable from addiction and a fiscal mechanism that efficiently generates revenue from higher-income consumers.

Nevertheless, the current tobacco excise calendar for the 2024-2026 period is unlikely to achieve these goals. Past nominal excise increases have been insufficient to decrease affordability of cigarettes because income growth has outpaced price growth, making cigarettes 40% more affordable in 2024

4 The complementarity of tobacco and alcohol consumption is also well-established in the demand-systems literature (Chaloupka and Warner, 2000; Gallet & List, 2003).

than in 2011. To reverse this trend and address the regressive welfare effects identified in the present analysis, Romania should adopt a more ambitious taxation reform, including the following evidence-based recommendations:

Recommendation 1: Adopt an income-adjusted excise-increase mechanism

The affordability analysis of Section 2.2 demonstrates that tobacco prices must grow faster than nominal wages to reverse the 40% affordability gain of the 2011-2024 period. The specific target is that annual nominal tobacco excise increases should exceed nominal average wage growth by a minimum of 10 pp for the 2026-2028 period. Concretely, if nominal wages grow at 8%-9% per year (consistent with current projections), excise increments should be at least 18%-19% per year. This trajectory is consistent with the minimum structures of the EU's Tobacco Taxation Directive (TTD) and would reduce affordability to approximately 2011 levels by 2028 or 2029, reversing the entirety of the affordability deterioration documented in this study.

Moreover, the income-adjusted excise increase should apply uniformly across all tobacco-product categories – including conventional cigarettes, heated tobacco products (HTPs), and other novel forms of nicotine delivery – to maintain real-price parity and prevent product switching by price-sensitive consumers as conventional cigarettes become less affordable. While the present empirical analysis does not separately identify HTPs in the household-level expenditure data, this recommendation is consistent with WHO guidance that tobacco tax policy should minimise opportunities for substitution between products arising from differential tax treatment.

Recommendation 2: Earmark a defined share of incremental excise revenues

The crowding-out effects documented in Section 5 demonstrate that tobacco consumption imposes externalities on the healthcare system and nutrition outcomes, with the externalities concentrated in low- and middle-income households. A dedicated Household Health Security Fund, financed by a ring-fenced share of incremental tobacco tax revenues above the 2024 baseline (e.g. 10%-15%), should finance two specific programmes: (i) co-payment waivers for smoking cessation pharmacotherapy within the reimbursement framework of Romania's National Health Insurance House (CNAS), and (ii) expanded coverage of early-detection screening (cardiovascular and oncological) in primary care for low- and middle-income households. The second of these directly addresses the negative health coefficient identified in the income-stratified econometric analysis of Section 5.3, in which low- and middle-income smoking households bear the largest health-displacement burden.

Recommendation 3: Establish a statutory affordability monitoring mechanism

The policy failure documented in this study (i.e. the increase of tobacco affordability by 40% over 13 years despite nominal tax increases) reflects an absence of systematic monitoring and automatic corrective mechanisms. The Ministry of Finance should calculate annually the affordability index, defined as the weighted average price of 100 packs of cigarettes divided by GDP per capita. A statutory trigger clause could be implemented to require automatic excise adjustment when the affordability index falls below a certain threshold value (e.g. the 2019 level of approximately 3.2%). This mechanism would prevent the gradual erosion of excise effectiveness during periods of strong nominal wage growth, removing the discretion that has been exercised against tobacco-control objectives over the period studied.

Recommendation 4: Build institutional capacity at ANAF and the Ministry of Finance for excise impact simulation

The policy failure documented in this study is not solely a consequence of insufficient political will; it also reflects a structural deficit in the analytical infrastructure available to the Romanian fiscal authority. The Ministry of Finance and the National Agency for Fiscal Administration (ANAF) under it currently lack a dedicated, institutionalised modelling capability for simulating the distributional and revenue effects of alternative excise trajectories before those trajectories are enacted. Excise decisions are consequently based on static revenue projections that do not account for demand elasticity, product substitution between cigarette segments and HTPs, illicit-trade responses, market structure, or the dynamic interaction between income growth and affordability. The construction of such a modelling capability (e.g. a standing technical unit charged with the maintenance of a partial-equilibrium tobacco demand model calibrated on the HBS microdata used in the present study), drawing on TETSiM and equivalent international toolkits, would substantially improve the quality of Romanian excise policy.

References

Aspen Institute Romania (2025). Tobacco landscape and taxation in Romania. Bucharest: Aspen Institute Romania. https://aspeninstitute.ro/wp-content/uploads/2025/04/20250408_Tobacco-Landscape-and-taxation_Romania_-Draft-8_-Revised_KN.pdf

Becker, G. S. & Murphy, K. M. (1988). A theory of rational addiction. *Journal of Political Economy*, 96(4), 675–700. https://doi.org/10.1086/261558

Chaloupka, F. J. & Warner, K. E. (2000). The economics of smoking, in: Culyer, A. J. & Newhouse, J. P. (eds.). *Handbook of Health Economics* (Vol. 1). Elsevier, Amsterdam, 1539–1627.

Chelwa, G. & Koch, S. F. (2019). The effect of tobacco expenditure on expenditure shares in South African households: A genetic matching approach. *PLoS ONE*, 14(9), e0222000. DOI:10.1371/journal.pone.0222000

Chisha, Z. (2025). Economic and health implications of tobacco and alcohol use in South Africa: A household expenditure analysis. Ph.D. Dissertation. University of Cape Town, Faculty of Commerce, School of Economics. http://hdl.handle.net/11427/41548

Cizmovic, M., Mugoša, A., Kovacevic, M. & Lakovic, T. (2022). Effectiveness of tax policy changes in Montenegro: Smoking behaviour by socio-economic status. *Tobacco Control*, 31(Suppl. 2), s124-s132. https://tobaccocontrol.bmj.com/content/tobaccocontrol/31/Suppl_2/s124.full.pdf

Deaton, A. (1997). The analysis of household surveys: A microeconometric approach to development Policy. Baltimore: Johns Hopkins University Press for the World Bank.

Do, Y. K. & Bautista, M. A. (2015). Tobacco use and household expenditures on food, education, and healthcare in low- and middle-income countries: A multilevel analysis. *BMC Public Health*, 15, 1098. https://doi.org/10.1186/s12889-015-2423-9

European Commission (2025). European Economic Forecast. Autumn 2025. https://economy-finance.ec.europa.eu/document/download/34538512-fff6-451a-8bbc-4c8d60e4d132_en?filename=ip327_en.pdf#page=158

Eurostat (2026a). Household final consumption expenditure by purpose (COICOP). Statistical database, code nama_10_co3_p3. https://doi.org/10.2908/NAMA_10_CO3_P3

Eurostat (2026b). Gross domestic product (GDP) and main components (output, expenditure and income) – annual data. Statistical database, code nama_10_gdp. https://doi.org/10.2908/NAMA_10_GDP

Eurostat (2026c). Gross domestic product (GDP) and main components per capita – annual data. Statistical database, code nama_10_pc. https://doi.org/10.2908/NAMA_10_PC

Eurostat (2026d). Household final consumption expenditure by purpose (COICOP 2018). Statistical database, code nama_10_cp18. https://doi.org/10.2908/NAMA_10_CP18

Gallet, C. A. & List, J. A. (2003). Cigarette demand: A meta-analysis of elasticities. *Health Economics*, 12(10), 821–835. doi: 10.1002/hec.765

Gamtessa, S. F. & Guliani, H. (2023). Tobacco prevalence and economic growth: Evidence from low and lower-middle-income countries. *Journal of Developing Areas*, 57(4), 201–219. https://doi.org/10.1353/jda.2023.a908653

John, R. M. (2008). Crowding out effect of tobacco expenditure and its implications on household resource allocation in India. *Social Science & Medicine*, 66(6), 1356–1367. doi: 10.1016/j.socscimed.2007.11.020

John, R. M., Chelwa, G., Vulović, V. & Chaloupka, F. J. (2023). Updated toolkit on using household expenditure surveys for research in the economics of tobacco control (2nd Edition). Tobacconomics, Johns Hopkins Bloomberg School of Public Health. https://www.economicsforhealth.org/files/research/856/tobacconomics-updated-hes-tool-kit-2nd-ed-eng-v2.1.pdf

Masa-Ud, A. G. A., Chelwa, G. & van Walbeek, C. (2020). Does tobacco expenditure influence household spending patterns in Ghana? Evidence from the Ghana 2012/2013 Living Standards Survey. *Tobacco Induced Diseases*, 18, 48. https://doi.org/10.18332/tid/120936

Merkaj, E., Imami, D. & Drope, J. (2025). The dual impact of tobacco spending: Crowding out essentials and crowding in addictive behaviors. *Scientific Reports*, 15, 24648. https://doi.org/10.1038/s41598-025-08648-1

Ministry of Finance of Romania (n.d.). Excise duty regime – Cigarette prices. https://mfinante.gov.ro/domenii/fiscalitate/impozite-si-taxe/regim-accize

NBR – National Bank of Romania (2025). NBR Medium-Term Forecast. Inflation Projection and the Associated Uncertainty Interval. February 2025. https://www.bnr.ro/en/2522-nbr-medium-term-forecast

Nerău, V., Ștefan, G., Geantă, M. & Zaharia, R. M. (2024). Impacts of tobacco excise increases on cigarette consumption and government revenues in Romania [Report]. Aspen Institute Romania (AIR). https://tobacconomics.org/research/impacts-of-tobacco-excise-increases-on-cigarette-consumption-and-government-revenues-in-romania-report/

Nyagwachi, A. O., Chelwa, G. & van Walbeek, C. (2020). The effect of tobacco- and alcohol-control policies on household spending patterns in Kenya: An approach using matched difference-in-differences. *Social Science & Medicine*, 256, 113029. https://doi.org/10.1016/j.socscimed.2020.113029

Özmen, M. U. (2023). Causal effect of education on tobacco use in low- and middle-income countries. *Nicotine and Tobacco Research*, 25(8), 1474–1480. https://doi.org/10.1093/ntr/ntad056

San, S. & Chaloupka, F. J. (2016). The impact of tobacco expenditures on spending within Turkish households. *Tobacco Control*, 25(5), 558–563. https://tobaccocontrol.bmj.com/content/tobaccocontrol/25/5/558.full.pdf

Solon, G., Haider, S. J. & Wooldridge, J. M. (2015). What are we weighting for? *Journal of Human Resources*, 50(2), 301–316. https://doi.org/10.3368/jhr.50.2.301

Sreeramareddy, C. T., Harper, S. & Ernstsen, L. (2018). Educational and wealth inequalities in tobacco use among men and women in 54 low-income and middle-income countries. *Tobacco Control*, 27(1), 26–34. https://tobaccocontrol.bmj.com/content/tobaccocontrol/27/1/26.full.pdf

United Nations (2018). Classification of individual consumption according to purpose (COICOP). Statistical Papers Series M, No. 99. https://digitallibrary.un.org/record/4005292/files/COICOP_2018.pdf

Vladisavljević, M., Zubović, J., Jovanović, O. & Đukić, M. (2024). Crowding-out effect of tobacco consumption in Serbia. *Tobacco Control*, 33(Suppl. 2), s88–s94. https://tobaccocontrol.bmj.com/content/tobaccocontrol/33/Suppl_2/s88.full.pdf

WHO – World Health Organization (2003). WHO Framework Convention on Tobacco Control. Geneva: World Health Organization.

WHO and Romanian Ministry of Health (2018). Global Adult Tobacco Survey: Romania 2018 Fact Sheet. Geneva: World Health Organization. https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/romania/gats-romania-2018-factsheet.pdf?sfvrsn=2206beb4_1

Wisana, I. D. G. K., Swarnata, A., Kamilah, F. Z., Meilissa, Y. & Kusnadi, G. (2022). The crowding-out effect of tobacco consumption in Indonesia. *Tobacco Control*, 33(Suppl. 2), s81-s87. https://tobaccocontrol.bmj.com/content/tobaccocontrol/33/Suppl_2/s81.full.pdf

Xin, Y., Qian, J., Xu, L., Tang, S., Gao, J. & Critchley, J. A. (2009). The impact of smoking and quitting on household expenditure patterns and medical care costs in China. *Tobacco Control*, 18(2), 150–155. https://doi.org/10.1136/tc.2008.026955

Appendix

ANNEX 1 - SAMPLE RECONCILIATION AND ADDITIONAL DESCRIPTIVE STATISTICS

Based on the Romanian HBS sample (N = 272,701 household-year observations spanning 2015 to 2023, after the standard exclusion filter applied to the raw 273,185 records). All numbers in this document are computed under the NIS sampling weights (*coefj*), making them representative of the Romanian household population. The exclusion filter described in Section 3.2 reduces the raw HBS sample of 273,185 observations to the analytic sample of 272,701 through the successive removal of three observations with zero or missing total expenditure, 395 with zero or missing total income, 85 with missing education, and one with non-tobacco expenditure equal to or below zero. The total removal is 484 observations, corresponding to 0.18% of the raw sample.

Table A1.1 / Share of tobacco-consuming households by per-adult-equivalent income tercile

Income tercile	Share of tobacco-consuming households	N (households)
Bottom (low income)	22.6%	≈ 90,900
Middle	36.9%	≈ 90,900
Top (high income)	53.5%	≈ 90,900

Notes: Income terciles computed year-specifically on per-adult-equivalent household income using the OECD equivalence scale. Tobacco-consuming household defined as a household with positive monthly tobacco expenditure recorded in the HBS. N = 272,701. The complement of each ratio is the non-smoker share in that tercile: 77.4% in the low tercile, 63.1% in the middle, 46.5% at the top.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

Table A1.2 / Year-by-year trajectory of tobacco expenditure and budget share, smoking households only

Year	Smoker pop. (millions)	Mean tobacco (RON/month)	Mean total exp. (RON/month)	Tobacco share of budget (%)
2015	2.54	276	2,674	12.21
2016	2.69	289	2,858	11.97
2017	2.94	312	3,224	11.48
2018	3.02	347	4,291	10.31
2019	3.03	380	4,837	9.96
2020	3.17	410	5,136	10.04
2021	3.11	451	5,647	10.01
2022	3.09	488	6,499	9.44
2023	3.04	531	7,215	9.31

Note: The smoker population estimates are weighted using NIS sampling weights. Mean tobacco expenditure and mean total consumption expenditure are weighted means in current Romanian lei (RON).
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

Table A1.3 / Year-by-year mean monthly total consumption expenditure by smoker status

Year	Non-smoker total (RON/month)	Smoker total (RON/month)	Smoker / Non-smoker ratio	Tobacco / non-smoker total
2015	1,745	2,674	1.53	0.158
2016	1,908	2,858	1.50	0.151
2017	2,184	3,224	1.48	0.143
2018	2,791	4,291	1.54	0.124
2019	3,122	4,837	1.55	0.122
2020	3,265	5,136	1.57	0.126
2021	3,815	5,647	1.48	0.118
2022	4,350	6,499	1.49	0.112
2023	4,864	7,215	1.48	0.109

Notes: Mean monthly total consumption expenditure in current Romanian lei (RON), computed as a weighted mean using INS sampling weights. The smoker-to-non-smoker ratio is column 3 divided by column 2. The tobacco-to-non-smoker-total ratio is the mean of smoker tobacco expenditure divided by the mean non-smoker total expenditure.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

Table A1.4 / Descriptive statistics of monthly household expenditure by COICOP category and income tercile (RON, weighted)

COICOP category	Low income tercile			Middle income tercile			High income tercile		
	Mean	*SD*	*CV*	*Mean*	*SD*	*CV*	*Mean*	*SD*	*CV*
Food and non-alcoholic beverages	467	291	0.62	674	370	0.55	933	500	0.54
Alcoholic beverages	15	30	1.98	25	41	1.63	45	63	1.38
Tobacco	56	131	2.35	125	211	1.68	247	312	1.26
Clothing and footwear	58	120	2.05	125	183	1.46	285	342	1.20
Housing, water, electricity, gas, fuels	249	250	1.00	398	371	0.93	504	458	0.91
Furnishings, household equipment, maintenance	68	134	1.96	137	251	1.83	260	542	2.08
Health	83	119	1.44	139	208	1.50	156	382	2.45
Transport	40	125	3.09	127	926	7.30	314	707	2.25
Information and communication	62	64	1.03	107	109	1.02	187	269	1.44
Recreation, sport, culture	31	51	1.64	48	79	1.65	96	212	2.21
Education services	1	14	23.64	3	47	17.21	10	114	12.04
HORECA	10	71	7.39	24	126	5.22	147	545	3.71
Insurance and financial services	2	34	13.68	9	62	7.01	34	139	4.09
Personal care and miscellaneous	11	39	3.54	24	64	2.69	67	156	2.31
Total household expenditure	**1,346**	**958**	**0.71**	**2,745**	**2,036**	**0.74**	**6,241**	**3,909**	**0.63**

Notes: Each mean entry reports the survey-weighted mean of monthly household expenditure on the indicated COICOP two-digit category in current Romanian lei (RON). SD = standard deviation. CV=coefficient of variation. N per tercile = approximately 90,900 household-year observations. INS sampling weights (*coefj*) applied throughout.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

Table A1.5 / Mean budget shares by income tercile and smoker status

Mean budget shares for the eight most important consumption categories, disaggregated by per-adult-equivalent income tercile[5] crossed with smoker status.

Category	Low NS	Low S	Mid NS	Mid S	High NS	High S
Food and non-alcoholic beverages	39.25	32.57	29.13	24.10	17.84	16.09
Housing & utilities	20.95	15.28	17.89	13.51	10.37	8.69
Health	7.78	3.98	7.28	3.90	3.32	2.22
Household maintenance	5.23	4.02	5.72	4.19	4.51	3.68
Transport	2.17	2.63	3.68	3.99	4.90	4.77
HORECA	0.45	0.74	0.70	0.83	1.91	1.78
Alcohol	0.93	2.09	0.77	1.26	0.65	0.87
Tobacco	0.00	16.21	0.00	11.82	0.00	8.04

Notes: Each entry reports the survey-weighted mean budget share (in % of total monthly consumption expenditure) for the indicated category, restricted to households of the indicated income tercile and smoker status. NS denotes non-smoking households, and S denotes smoking households. Income terciles defined on per-adult-equivalent income using the OECD-modified equivalence scale, computed year-specifically. N per cell ranges from approximately 18,000 to 80,000 household-year observations.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

Table A1.6 / Mean monthly total consumption expenditure by income tercile and smoker status

Income tercile	All households	Non-smoking	Smoking	Smoker / Non-smoker ratio	Smoker share in tercile
Low (bottom third)	1,346	1,240	1,710	1.38	22.6%
Middle	2,745	2,480	3,198	1.29	36.9%
High (top third)	6,241	5,895	6,542	1.11	53.5%
All terciles	***3,760***	***3,091***	***4,786***	***1.55***	***39.5%***

Notes: Smoker household defined as having positive monthly tobacco expenditure recorded in the HBS. The smoker-to-non-smoker ratio is the smoking-household mean divided by the non-smoking-household mean within the same tercile. The smoker share in tercile is the survey-weighted proportion of households in the tercile with positive tobacco expenditure. Bottom row reports the corresponding statistics across the full sample. INS sampling weights (*coefj*) applied throughout.
N = 272,701 household-year observations.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS).

ANNEX 2 - SUPPLEMENTARY ESTIMATION RESULTS AND DIAGNOSTICS

Stata IV regression output

The following pages reproduce the Stata IV regression output for each of the 13 equations estimated under the Vladisavljević et al. (2024) specification described in Section 3.1. The output is presented in standard *ivreg2* format with one exception: the county-fixed effects are absorbed by within-transformation, and their individual coefficients are not reported, consistent with standard presentation practice for panel specifications with large fixed-effect dimensions. The instruments for lnM and $(lnM)^2$ are $lnTotal$ and $(lnTotal)^2$ in all equations; the instruments for *pq* vary by equation according to the selection rule of Section 3.1 and are reported in the command line above each regression.

[5] Income terciles are defined year-specifically using per-adult-equivalent household income computed under the OECD-modified equivalence scale (one unit for the first adult, 0.5 units for each additional adult, 0.3 units for each child under 15 years of age).

Table A2.1 / Second-stage instrumental-variable estimates of the conditional budget-share (crowding-out) system, Romanian HBS 2015-2023

Dependent variable (budget share)	pq	ln M	(ln M)²	d	d × ln M	d × (ln M)²	urban	size	Centered R²
Food & non-alcoholic beverages	-0.0002824***	-0.2051867***	0.0050125***	0.6259711***	-0.1694381***	0.0129452***	0.0220677***	0.0303077***	0.4574
(w_food)	*(0.0000631)*	*(0.0216846)*	*(0.0014012)*	*(0.1027747)*	*(0.0266088)*	*(0.0018688)*	*(0.0054133)*	*(0.0011601)*	
Clothing & footwear (w_clothing)	-0.0000612***	0.0655971***	-0.0034040***	0.0887807**	-0.0240121**	0.0019202***	0.0006865	0.0011123***	0.0249
	(0.0000184)	*(0.0075054)*	*(0.0005045)*	*(0.0365894)*	*(0.0096310)*	*(0.0006651)*	*(0.0016683)*	*(0.0003264)*	
Housing & utilities (w_housing)	0.0000322	0.1786713***	-0.0130553***	0.3066187***	-0.0807530***	0.0049487***	-0.0052006	-0.0048004***	0.1923
	(0.0000577)	*(0.0246105)*	*(0.0014793)*	*(0.0954368)*	*(0.0252506)*	*(0.0018988)*	*(0.0044230)*	*(0.0008930)*	
Furnishings & household maintenance	0.0001781*	0.0744111***	-0.0036836***	-0.1336203*	0.0407721*	-0.0040698**	-0.0035375	-0.0034177***	-0.0531
(w_hhmaint)	*(0.0000939)*	*(0.0154670)*	*(0.0010735)*	*(0.0781698)*	*(0.0226897)*	*(0.0020744)*	*(0.0021680)*	*(0.0004127)*	
Health (w_health)	0.0001588**	0.0534434***	-0.0037065***	-0.2292357***	0.0532513**	-0.0040793**	0.0007190	-0.0006621	0.1462
	(0.0000749)	*(0.0145034)*	*(0.0009472)*	*(0.0766080)*	*(0.0213323)*	*(0.0018147)*	*(0.0019566)*	*(0.0004682)*	
Transport (w_transport)	0.0005773***	0.0907458***	-0.0053855***	-0.6324844***	0.1863211***	-0.0164741***	-0.0085786***	0.0014328**	-1.5571
	(0.0000965)	*(0.0147433)*	*(0.0010407)*	*(0.1124222)*	*(0.0330819)*	*(0.0027970)*	*(0.0023463)*	*(0.0005695)*	
Information & communication (w_ict)	0.0000352	0.0145087**	-0.0020152***	0.0928825***	-0.0210147**	0.0010019	0.0028914***	0.0042910***	0.0755
	(0.0000251)	*(0.0061719)*	*(0.0004189)*	*(0.0306995)*	*(0.0083135)*	*(0.0006571)*	*(0.0008925)*	*(0.0002426)*	
Recreation, sport & culture (w_leisure)	-0.0000138	-0.0706274***	0.0040906***	-0.0035439	0.0010599	-0.0000082	0.0019896***	0.0016868***	0.1347
	(0.0000125)	*(0.0059075)*	*(0.0003622)*	*(0.0241799)*	*(0.0062887)*	*(0.0004569)*	*(0.0005907)*	*(0.0002038)*	
Education (w_educ_cat)	-0.0000080***	-0.0018573*	0.0001731***	0.0064459**	-0.0019368**	0.0001822**	0.0000707	0.0002485***	-0.0027
	(0.0000027)	*(0.0010802)*	*(0.0000665)*	*(0.0031406)*	*(0.0008995)*	*(0.0000749)*	*(0.0000499)*	*(0.0000676)*	
Restaurants & accommodation	-0.0000529**	-0.0383679***	0.0033400***	0.1163804***	-0.0284949***	0.0020390***	0.0005778	-0.0022789***	0.0250
(w_horeca)	*(0.0000251)*	*(0.0077053)*	*(0.0005631)*	*(0.0363605)*	*(0.0099759)*	*(0.0007451)*	*(0.0008492)*	*(0.0004280)*	
Insurance & financial services	-0.0000225***	-0.0055319***	0.0005926***	0.0027111	-0.0014667	0.0002737	0.0003250	-0.0001572	-0.0067
(w_finserv)	*(0.0000067)*	*(0.0014776)*	*(0.0001050)*	*(0.0084493)*	*(0.0024106)*	*(0.0001995)*	*(0.0002981)*	*(0.0001156)*	
Personal care & miscellaneous	-0.0000125	0.0118469***	-0.0004931***	0.0416969***	-0.0108966***	0.0007580***	0.0007786**	-0.0005718***	0.0088
(w_perscare)	*(0.0000077)*	*(0.0028178)*	*(0.0001879)*	*(0.0113885)*	*(0.0031671)*	*(0.0002466)*	*(0.0003770)*	*(0.0001870)*	
Alcoholic beverages (w_alcohol)	0.0000112	-0.0032731	0.0002084	0.3006090***	-0.0663981***	0.0036157***	-0.0021452***	-0.0003105**	0.1082
	(0.0000089)	*(0.0030421)*	*(0.0001935)*	*(0.0250809)*	*(0.0061789)*	*(0.0003934)*	*(0.0005162)*	*(0.0001319)*	

Notes: Each pair of rows reports the second-stage 2SLS coefficient (top) and its cluster-robust standard error in parentheses (bottom) for one budget-share equation. Budget shares are expressed as fractions of the 13-category non-tobacco consumption aggregate. Standard errors are clustered at the county level (47 clusters: 41 counties and 6 districts of Bucharest). All equations: N = 272,673 household-year observations; county-fixed effects absorbed by within-transformation; eight year dummies, three activity-status dummies, and five education dummies included but not reported.

Endogenous regressors (*pq*, *ln M*, *(ln M)²*) are instrumented as described in Section 3.1 following Vladisavljević et al. (2024). Variable definitions (per Section 3.1): *pq* = tobacco price term (unit value); *ln M* = log total household expenditure; *d* = smoking-household indicator; *d* × *ln M* and *d* × (*ln M*)² = smoker-specific Engel-curve interactions; urban = urban-locality indicator; size = household size. Coefficients are reported at the precision of the Stata output. Centred R^2 is the 2SLS centred R^2 and may be negative; it has no goodness-of-fit interpretation under instrumental variables.

Significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Identification and overidentification diagnostics for each equation are reported in Table A2.2.

Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS), survey-weighted using NIS sampling weights (*coefj*).

Table A2.2 / Identification and specification diagnostics for the conditional budget-share system, Romanian HBS 2015-2023

Eq.	Dependent variable (budget share)	Instrument pair for pq	First-stage partial R^2 (pq)	First-stage F (pq)	Hansen J	Hansen p	Status
1	Food & non-alcoholic beverages (w_food)	male_ratio + pq_loo_cyact	0.01785	58.33	0.161	0.6879	Clean
2	Clothing & footwear (w_clothing)	pq_loo_cyact + d_loo_cyact	0.02060	43.36	0.099	0.7527	Clean
3	Housing & utilities (w_housing)	pq_loo_cyact + d_loo_cy	0.01719	26.54	2.315	0.1281	Clean
4	Furnishings & household maintenance (w_hhmaint)	adult_ratio + d_loo_cyact	0.00552	15.49	0.272	0.6017	Weak
5	Health (w_health)	pq_loo_cy + d_loo_cyact	0.00795	23.69	0.745	0.3882	Weak
6	Transport (w_transport)	male_ratio + d_loo_cy	0.00597	39.82	0.162	0.6869	Weak
7	Information & communication (w_ict)	pq_loo_cy + d_loo_cyact	0.00795	23.69	0.771	0.3798	Weak
8	Recreation, sport & culture (w_leisure)	pq_loo_cyact + d_loo_cyact	0.02060	43.36	5.361	0.0206	Fails
9	Education (w_educ_cat)	male_ratio + pq_loo_cyact	0.01785	58.33	1.412	0.2348	Clean
10	HORECA (w_horeca)	adult_ratio + pq_loo_cyact	0.01672	25.32	0.137	0.7113	Clean
11	Insurance & financial services (w_finserv)	pq_loo_cyact + d_loo_cyact	0.02060	43.36	14.961	0.0001	Fails
12	Personal care & miscellaneous (w_perscare)	pq_loo_cyact + d_loo_cyact	0.02060	43.36	0.173	0.6770	Clean
13	Alcoholic beverages (w_alcohol)	pq_loo_cyact + d_loo_cy	0.01719	26.54	1.050	0.3054	Clean

Notes: One row per budget-share equation. The instrument pair for *pq* is selected according to the rule in Section 3.1 (strongest first-stage partial R^2 among pairs passing the Hansen J test); the leave-one-out cluster means are denoted _loo_cy (county-year) and _loo_cyact (county-year-activity). *ln M* and (*ln M*)^2 are instrumented by *ln(total)* and *ln(total)*^{2} in every equation, with first-stage partial R^2 exceeding 0.989 throughout (not shown).
First-stage F is the Kleibergen-Paap cluster-robust statistic for *pq*; the Stock-Yogo 10% maximal-bias critical value is ≈ 7.03 (one endogenous regressor, two instruments), which every equation exceeds. The Hansen J statistic tests the single overidentifying restriction (χ^2 with 1 d.f.).
Status 'Clean' = adequate first-stage strength (partial $R^2 \geq 0.015$) and overidentification not rejected; 'Weak' = exclusion not rejected but first-stage partial $R^2 < 0.015$ (interpret with caution); 'Fails' = Hansen J rejects the joint exclusion restriction at the 5% level.
Source: Authors' calculations based on Romanian HBS 2015-2023 microdata (NIS), survey-weighted using NIS sampling weights (*coefj*); N = 272,673.

IMPRESSUM

Herausgeber, Verleger, Eigentümer und Hersteller:
Verein „Wiener Institut für Internationale Wirtschaftsvergleiche“ (wiiw),
Wien 6, Rahlgasse 3

ZVR-Zahl: 329995655

Postanschrift: A 1060 Wien, Rahlgasse 3, Tel: [+431] 533 66 10, Telefax: [+431] 533 66 10 50
Internet Homepage: www.wiiw.ac.at

Offenlegung nach § 25 Mediengesetz: Medieninhaber (Verleger): Verein "Wiener Institut für Internationale Wirtschaftsvergleiche", A 1060 Wien, Rahlgasse 3. Vereinszweck: Analyse der wirtschaftlichen Entwicklung der zentral- und osteuropäischen Länder sowie anderer Transformationswirtschaften sowohl mittels empirischer als auch theoretischer Studien und ihre Veröffentlichung; Erbringung von Beratungsleistungen für Regierungs- und Verwaltungsstellen, Firmen und Institutionen.

wiiw.ac.at