

Taxing Tobacco in Georgia

Welfare and Distributional Gains of Smoking Cessation

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Abstract

This paper analyzes the welfare and distributional impacts of increasing taxes on cigarettes in Georgia. Increasing taxes on tobacco is an effective measure to reduce smoking. According to some estimates, increasing tobacco taxes could save more than GEL 3.6 billion and 53 thousand lives over a 15-year period. However, concerns over potentially regressive effects on the poor are often raised. An Extended Cost Benefit Analysis (ECBA) is applied to simulate the welfare and distributional impacts of raising prices on cigarettes. Decile-specific price elasticities of demand are estimated to account for heterogenous behavioral responses of different income groups. Empirical estimations confirm that poorer households in Georgia tend to reduce consumption

more intensely when faced with higher tobacco prices. The estimated magnitude and distribution of elasticities are comparable to peer countries. The simulations based on household survey data suggest that the long-term net distributional effects of increasing taxes on cigarettes in Georgia are likely progressive. Incorporating the indirect benefits of reduced smoking—reductions in medical expenses and earnings from averted premature deaths—could bring small, albeit positive, income gains for large sectors of the population. The magnitude of those benefits is most significant among lower-income households, potentially contributing to lift them out of poverty.

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Taxing Tobacco in Georgia: Welfare and Distributional Gains of Smoking Cessation

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I. Introduction

Georgia faces high economic and social costs of health. Health spending as a share of GDP was 8.9 percent in 2016, like countries with higher income levels (OECD 2018). Consumption of tobacco is among the leading causes of disease and deaths in Georgia. Smoking prevalence in the Georgian population is among the highest in the European region, and it has continued to increase over the last decade (NCDCPH et al. 2016). Consumption of tobacco is estimated to account for 7,000 to 11,000 annual deaths in Georgia (The Tobacco Atlas 2019; UNDP et al. 2018).

Efforts by the Government of Georgia (GoG) to control tobacco have received international recognition. Recently introduced legislation has been called “one of the strongest single comprehensive tobacco control laws in the world” (The Tobacco Atlas 2018). Despite these efforts, meeting the target reductions in smoking rates poses a challenging policy goal. Taxes are recognized as an effective measure to reduce tobacco consumption among smokers, and to dissuade initiation (World Bank 1999). However, concerns over potentially regressive effects are raised in opposition to higher taxes on tobacco. It is often argued that poorer households suffer the most from a tax increase, as tobacco products represent higher shares of the budgets.

This paper addresses the policy concern of the welfare and distributional impact of increasing taxes on cigarettes. It seeks to determine whether the claims of the regressive effects of tobacco tax policies have empirical validity in the case of Georgia. An Extended Cost Benefit Analysis (ECBA) is performed to account for the negative effects on household budgets as cigarette prices increase, as well as the indirect welfare benefits derived from the health benefits of reducing smoking. Decile-specific price elasticities of demand for cigarettes are used to incorporate heterogeneous behavioral responses by different income groups of the population.

The estimates of price-elasticities suggest that -when faced with higher cigarette prices- poorer households in Georgia tend to reduce their consumption more intensely than higher-income peers. The magnitudes (under the base-scenario) of those elasticities are higher than similar exercises in other country settings. The ECBA is simulated on household expenditure data from the Household Income and Expenditure Survey (HIES, formerly the Integrated Household Survey, IHS). The findings suggest that the net distributional effect of increasing taxes on cigarettes in Georgia is not regressive, but instead highly progressive. Increasing prices of tobacco dissuades smoking and allows households to free up resources for other consumption goods. Incorporating the indirect benefits of reducing smoking—reductions in tobacco-related medical expenses and additional earning from avoiding premature deaths—further offsets the negative price shock from the tax increase on household budgets. In the long-run, the net effects are positive across the population, with poorer households receiving the highest benefits, relative to their incomes.

The next section provides a background on the consumption patterns, control measures and taxation policies of tobacco products in Georgia. Section III. reviews the previous literature on the health and economic consequences of tobacco consumption and surveys existing research in Georgia. The fourth section outlines the components and theoretical assumptions of the ECBA methodology. Section V. presents an overview of the data sources and basic descriptive statistics. Simulation results for each component of the model, as well as the net distributional income effects are reported in Section VI. The results are then used to simulate the potential changes in poverty, and the number of lives saved from the tax increase. The final section discusses the likely implications of these results for the policy and research agendas in Georgia.

II. Background

Tobacco consumption

Georgia faces high and increasing rates of tobacco consumption. The smoking prevalence in Georgia is among the highest in countries of the European region of the World Health Organization (WHO) (NCDCPH et al. 2016). Approximately one million Georgians are current tobacco users, and prevalence rates have increased over the last two decades (NCDCPH et al. 2016).

High prevalence of tobacco consumption is particularly concentrated among adult males ([Table 1](#)). In 2016, 57 percent of adult males were smokers and 51.5 percent were daily smokers (WHO 2017). Smoking among females is less common. Approximately 7 percent of women were smokers in 2016, and 6.2 percent were daily smokers (WHO 2017). More concerning, the rate of current female smokers doubled in recent years (UNDP 2018). According to the Global Youth Tobacco Survey (GYTS 2017), 12 percent of teenagers (13 to 15 years old) consume tobacco, including 17 percent of boys, and 8 percent of girls.

Smokeless tobacco is more common among the youth. Only 0.6 percent of adults (ages 18-64) consumed smokeless tobacco in 2010, but 3.4 percent of children (ages 12-15) consumed these products in 2014 (NCDCPH et al. 2018). Second-hand smoking affects a large share of the population. More than 40 percent of population—including children and pregnant women—are exposed to second-hand smoke (UNDP et al. 2016). Over 43 percent of students report suffering exposure to tobacco smoke at home (GYTS 2017).

Cigarette smoking is the most common form of tobacco consumption.² Filtered cigarettes are the most common type of tobacco product consumed, and only a small percentage of the population consumes unfiltered cigarettes or both (Little et al. 2019).³ Evidence also suggests that smoking frequency (the number of cigarettes smoked daily) tends to be higher for individuals with low educational attainment and those unemployed (Little et al. 2019).⁴

Table 1. Adult smoking prevalence in Georgia

(Percent of adults)

	Male	Female	All
Current tobacco smokers	57.0	7.0	31.0
Daily tobacco smokers	51.5	6.2	28.0

Source: Taken from WHO 2017b. Data from the STEPS survey 2016, for adults aged 18 to 69.

² Georgia was an important producer of tobacco leaves and manufactured cigarettes for the Soviet Union. The tobacco industry collapsed in the early 1990s after independence, leading to the dominance of domestic markets by international brands (Little et al. 2019).

³ According to a household survey on tobacco consumption patterns conducted in 2017, 87 percent of smokers consumed filtered cigarettes, 9 percent consumed unfiltered cigarettes, and 3 percent consumed both. Only 1 percent preferred other products, including cigars and e-cigarettes. The survey interviewed 2,997 smokers in the cities of Tbilisi and Kutaisi, and the municipalities of Zugdidi, Gori and Akhaltsikhe. It was not designed to be representative of the national population (Little et al 2019).

⁴ Individuals with less than secondary school education smoked 23 cigarettes per day, and those unemployed smoked 22 cigarettes per day (Little et al. 2019).

Tobacco control policies

Georgia is a party to the WHO’s Framework Convention on Tobacco Control (FCTC) since 2006. The State Tobacco Control Committee was created in 2013, chaired by the Prime Minister. And the Tobacco Control National Strategy of the Government of Georgia—through the Decree №196, published in July 2013—set the goal of reducing smoking prevalence among the adult population by 2 percent annually.

A major legislative reform on tobacco control was adopted by the Georgian Parliament in May 2017, after unsuccessful attempts in previous years. The main components of the law are summarized on [Table 2](#), and a more detailed description is included in [Annex 1](#). Georgia’s tobacco-control efforts have received international recognition. The new legislation has been called “one of the strongest single comprehensive tobacco control laws in the world” (The Tobacco Atlas 2018). The policy changes have enjoyed popular support among Georgians.⁵ However, the implementation of some provisions has been postponed until the end of 2022.

In 2017, Georgia was selected as partner to the FCTC’s 2030 project (the only country from the Europe and Central Asia region). This initiative seeks to provide special assistance to fifteen partner countries to foster the implementation of the Convention (WHO 2017). Additionally, tobacco control has important implications for Georgia’s process towards integration to the European Union (EU). Within the 2014 Association Agreement signed with the EU, Georgia is required to implement the provisions of the tobacco product and tax directives. The EU Directive 2011/64/EU on the structure and rates of excise duty on manufactured tobacco requires Georgia to meet counter-illicit trade and tobacco tax rates obligations—based on the FCTC’s targets—by 2021.

Tobacco taxation policy

Taxes on tobacco products in Georgia were introduced in 1997. However, locally manufactured cigarettes enjoyed substantially lower tax rates, while the fixed specific excise rates allowed the real value of taxes to erode until 2004 (Little et al. 2019).

Despite substantial efforts for tobacco-control, taxes on tobacco in Georgia remain lower than international best practices. Tobacco products are taxed with a value-added tax (VAT), as well as *ad valorem* and specific excise duties. Between 2005 and 2014, the total share of excise duties averaged 35 percent of the price of a pack of cigarettes (NCDCPH 2016). The most recent amendment to the Tax Code on tobacco taxation, increased the *ad valorem* excise tax from 10 percent to 30 percent, and equalized taxes for filtered and unfiltered cigarettes starting in January 2019 (Agenda.ge 2018). More recently, in November 2019, new fiscal policies were introduced to increase the tax burden on rolled tobacco.

Under the Association Agreement and the EU Directive 2011/64/EU, Georgia has committed to implementing—by 2021—excise duties on cigarettes of:

- (a) 60 percent of the average weighted retail price, and
- (b) Not less than 90 euros per 1,000 cigarettes.⁶

⁵ According to the UNDP, 80 percent of Georgians support smoke-free regulations, and 90 percent support the ban on advertising (UNDP et al. 201X).

⁶ Under an original plan to meet the EU requirements by 2020, the total excise tax would have had to increase by 70 tetri annually, starting in 2016. Assuming complete pass-through of taxes to consumer price, the average sales price of a pack of filtered cigarettes would have to be 7.22 GEL by 2020 (UNDP et al. 2016). As of January 2019, the cost of a pack of Winston, Camels and Magna cigarettes were reported at GEL 4.80, GEL 4.50 GEL and to GEL 4.20, respectively, after the recent increase in *ad valorem* tax (Agenda.ge 2019).

Excise taxes on tobacco constitute a relevant component of fiscal revenue in Georgia. In the context of the current fiscal consolidation efforts, the risks of revenue shortages associated with the elimination of taxes on reinvested profits “have been minimized by a sharp increase in excise tax rates on fuel and tobacco starting in 2017” (World Bank 2018).

Table 2. Main changes introduced in the 2017 reform on tobacco-control

Interventions	Former policy	2017 Tobacco control legislation
Raise cigarette taxes (FCTC Art. 6)	Excise taxes of 54 percent of retail prices of the most sold brand.	12 percent excise tax increase in 2017.
Smoke-free policies (FCTC Art. 8)	Ban on smoking in all public places, but lack of enforcement in cafes, bars, pubs.	Ban on smoking in all closed areas, other than private homes, penitentiaries and mental health institutions.
Labelling and packaging (FCTC Art. 13)	Health warnings required to cover 30 percent of packaging. No pictograms allowed.	Increased size of health warning and pictograms introduced.
Advertisement ban (FCTC Art. 11)	Ban on advertising on TV and radio.	Ban on all forms of tobacco promotion.

Source: UNDP et al. 2018. Note: Taxes are regulated by the Tax Code and not included in tobacco-control legislation.

III. Literature review

The health and economic costs of tobacco

A large body of cumulative evidence has shown the causal impact of smoking on illness and premature deaths (Jha and Peto 2014). Tobacco use is responsible for the premature death of one-third to one-half of people who smoke (Peto et al. 1996). It is estimated that 8 million people die globally from tobacco use every year (WHO 2019). Close to 10 percent of those deaths result from exposure of nonsmokers to secondhand smoke.

Across the world, smoking-related illnesses cost billions of dollars each year, imposing heavy economic tolls on households and countries (NCI and WHO 2016; Xu et al. 2015). Tobacco-related diseases are estimated to result in 6 percent of total global spending on health. And the total economic cost of smoking—including productivity losses from deaths and disability—are calculated at 1.8 percent of the world’s annual gross domestic product (GDP) (Goodchild, Nargis, and Tursan d’Espaignet 2018). Nearly 80 percent of the world’s smokers live in low- and middle-income countries (WHO 2015a). These countries are already burdened by 40 percent of the global economic costs of smoking (Goodchild, Nargis, and Tursan d’Espaignet 2018).

The mechanisms of taxing tobacco on household welfare

Smoking cessation is effective and quick in reducing tobacco-related mortality. People who quit by age 40 get back nearly the full decade of life they would have lost from continued smoking (Jha and Peto 2014). Among tobacco-control policies, tobacco taxes are considered the most efficient policy intervention to reduce tobacco consumption (World Bank 1999; NCI and WHO 2016).

Taxes encourage current smokers to quit and discourage potential consumers to initiate, by increasing prices and reducing the affordability of tobacco products. [Figure 1](#) was adapted from the work by Postolovska, Lavado, Tarr and Verguet (2017), to summarize the different channels through which increasing tobacco taxes can affect household incomes. After a tax increase, smokers who continue to purchase the same amount of tobacco will face a negative budget shock, as the tax-induced higher price of

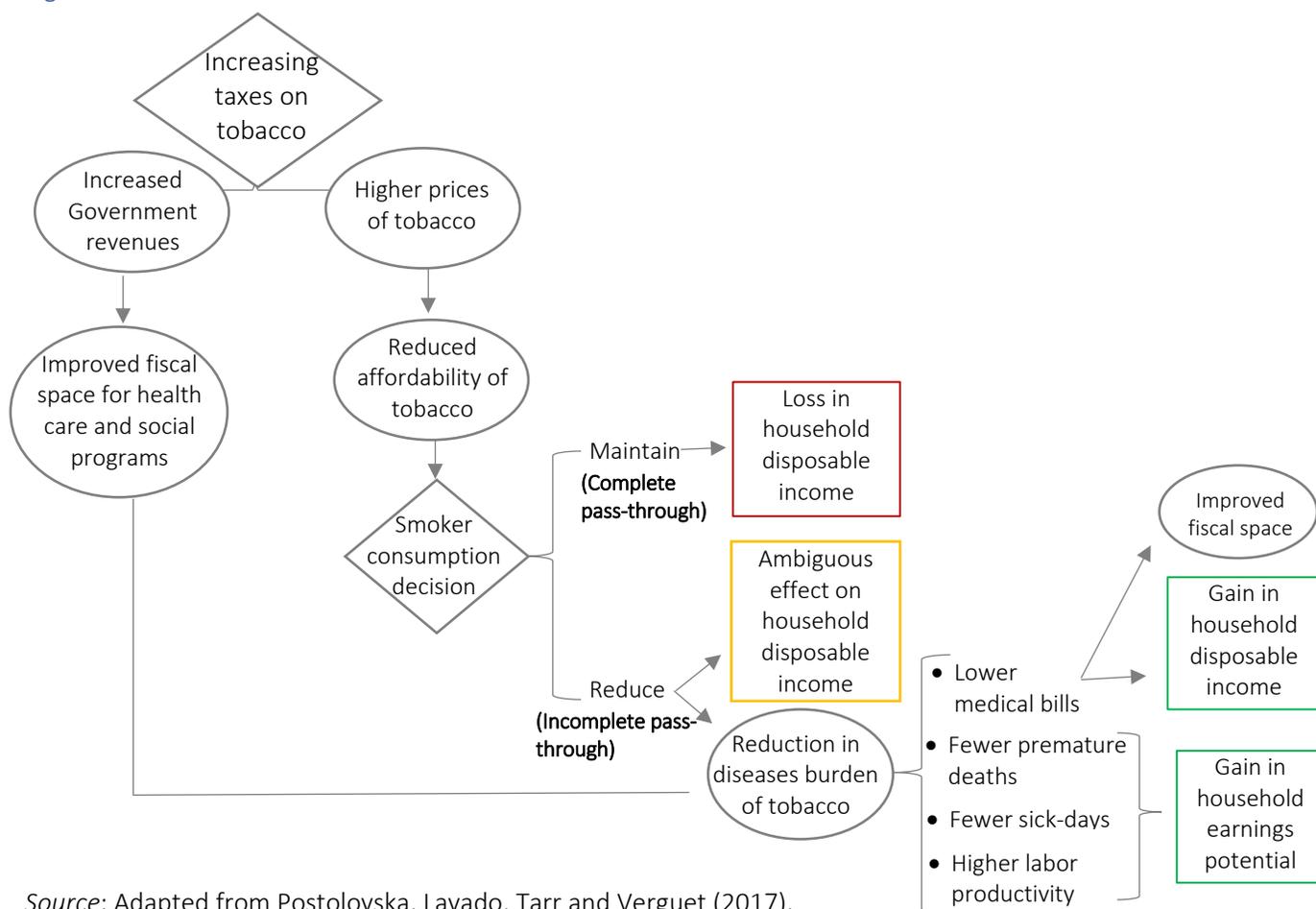
tobacco translates to higher shares of tobacco in household budgets and a loss in disposable income to consume other goods and services. The impact is likely regressive, as lower-income smokers face a larger budget shock from a price increase, relative to their incomes. This “complete pass-through” scenario, however, assumes that consumers’ behavior is unaffected by the price increase. However, faced with higher prices of tobacco, smokers are likely to adjust their behavior and reduce consumption. The extent of such adjustment is expressed by the price elasticity of demand parameter. The change in disposable incomes after the tax increase is ambiguous. Depending on the price elasticity—whether smokers give up enough smoking—disposable household income may be lower or higher after the tax increase.

Other medium- and long-term benefits of reducing tobacco consumption are often overlooked. When smokers respond to price changes by reducing and ceasing consumption, they improve their health and well-being, and generate several economic benefits for their households. These benefits translate to positive gains in household incomes—for example, by reducing medical bills and the years of productive lives lost to tobacco-related disease—and work to offset the short-term negative budget shock. The net effect of increasing taxes on tobacco must weigh the losses against these gains to household incomes.

Moreover, these gains to household income represent only a fraction of the potential welfare benefits of taxing tobacco. Increasing taxes on cigarettes can also mobilize resources for government spending in public health and other policy priorities. Public revenue collection will surge following a tax increase, although effective tobacco taxes are expected to lead to a decreasing tax base and overall lower revenue collection (from tobacco excises) in the medium- to long-term.⁷ During this transition, any additional fiscal resources derived from tobacco taxes can be invested in other tobacco-control strategies or in social programs that further increase household welfare. Other effects—such as the intrinsic value of the human lives saved, the reduction in time allocated to care for sick family members, and many other improvements in the quality of life of former smokers and their families—are harder to quantify but represented fundamental welfare gains of reducing tobacco consumption.

⁷ Observing a decreasing tax base and lower revenue collection from tobacco excises should be interpreted as a successful policy outcome. The ultimate goals of tobacco taxation instruments are to improve public health, and to enhance public finance sustainability by reducing the overall fiscal and societal costs of tobacco use.

Figure 1. Mechanisms from tobacco taxes to costs and benefits on household welfare



Source: Adapted from Postolovska, Lavado, Tarr and Verguet (2017).

Recent empirical applications use an Extended Cost Benefit Analysis (ECBA) framework to account for these mechanisms that translate higher taxes on tobacco to changes in welfare of the population.⁸ By incorporating a more comprehensive view of the mechanisms, costs and benefits of increasing taxes on tobacco, these studies consistently find evidence against the arguments of regressive effects. Ten country studies published by the World Bank highlight that the medium- and long-term benefits of reducing cigarette consumption often outweigh the short-term costs of the tax, resulting in net income gains, particularly among lower-income groups (Fuchs and Del Carmen 2018; Fuchs, Del Carmen and Mukong 2018; Fuchs and Gonzalez Icaza 2019; Fuchs and Matytsin 2018; Fuchs and Meneses. 2017a, 2017b, 2018; Fuchs, Orlic and Cancho 2019; and a cross-country comparative analysis by Fuchs, Paz and Gonzalez Icaza, 2019). Consistently across countries, the net effects show a progressive pattern, often with long-term positive income gains for large sectors of the population and especially for poorer households. With the available data, the reduction in medical bills tends to be the most significant effect, suggesting a role for tobacco taxation (and other safety net programs) to protect households against catastrophic spending and impoverishment because of tobacco-related disease. The progressive distributional net effect is often driven by higher combinations of price-elasticities of demand and smoking prevalence rates, among poorer

⁸ The detailed methodology of the ECBA is explained in section IV.

deciles. If lower-income households are more likely to reduce their high consumption rates of tobacco when faced with a price increase, they can naturally capture the highest benefits of the tax reform.

Similar studies have been conducted in the Europe and Central Asia (ECA) region, in countries that may be considered Georgia's peers. Using the ECBA on Armenia, Postolovska et al. (2017) find that increasing the cigarette excise tax rate to 75 percent of the retail price would bring large health and financial benefits to Armenian households, with pro-poor impacts. They estimate that 88 thousand premature deaths, US\$63 million in out-of-pocket medical expenses, 22 thousand poverty cases, and 32 thousand cases of catastrophic health expenditures could be averted with the price increase. The bottom 40 percent of the population would concentrate half of the averted premature deaths and 27 percent of the prevented cases of poverty. In the Kyrgyz Republic, a 40 percent price increase on cigarettes could contribute to avert 55,000 tobacco-related premature deaths, US\$1.3 million in OOP expenditures, US\$3.8 million in government expenditure to treat tobacco-related disease, and 6,400 cases of poverty. The poorer quintiles would concentrate the highest relative benefits (Postolovska et al. 2018).

Available evidence from Georgia

Total health care expenditures are particularly high in Georgia, estimated at GEL 2,871 million in 2016 (WDI 2016). The share of 8.4 percent of these expenditures in GDP in Georgia is comparable to the average for the higher-income OECD countries (which had average health spending of 8.9 percent of GDP in 2016) (OECD 2018). Moreover, out-of-pocket payments account for 56 percent of health expenditures or 4.7 percent of GDP in Georgia, despite large reductions over recent years.⁹ Based on budget data from the IHS, health care accounted for 12.5 percent of the cash consumption expenditure by Georgian households in 2018 (Geostat 2019).

Some previous work has attempted to estimate the health and economic costs specifically linked to tobacco in Georgia, as well as the potential outcomes of different policy options for tobacco-control. According to the Tobacco Atlas, the economic costs of smoking in Georgia add to GEL 619 million, including direct health care costs and the indirect costs in productivity associated with tobacco-attributable mortality and morbidity (The Tobacco Atlas 2019).

A study conducted in partnership between the UNDP, the WHO FCTC Secretariat and the NCDCPH (National Center for Disease Control and Public Health of Georgia) analyzed the effect of implementing four FCTC priority policies for tobacco-control (UNDP et al. 2018).¹⁰ The study calculated the total economic costs of tobacco in Georgia at GEL 825 million annually, or 2.43 percent of GDP in 2016. Those estimated costs included direct health care expenses and the indirect economic costs related to productivity losses (related to premature mortality, increased morbidity, and time allocation to smoking breaks). A back of the envelop estimation suggests that tobacco-related medical expenses amounted to GEL 327 million in 2016.¹¹ The indirect losses in productivity accounted for the remaining 60 percent of the total burden of tobacco. Full implementation and enforcement of the four interventions could potentially avert GEL 3.6 billion in health care and economic losses over a 15-year period (including 1.4 billion in direct health care expenses and GEL 2.2 billion in productivity losses). It would also save 53,110 lives over the 15-year period, at a financial cost

⁹ Calculations for 2016, based on the WDI database. This share has dropped significantly from 72.7 percent in 2010.

¹⁰ The policies considered are: (1) Increasing taxes on tobacco to reduce affordability (FCTC Art. 6), (2) Banning indoor smoking in public places (FCTC Art. 8), (3) WHO-FCTC recommended labeling and packing standards (FCTC Art. 11), and (4) Banning tobacco advertising, sponsorship and promotion (FCTC Art. 13).

¹¹ The authors approximate the tobacco-related medical expenses by applying a Smoking Attributable Fraction (SAF) of 8 percent on the total health care expenditures in the country (NCDCPH et al. 2016).

of GEL 1,000 per 5.3 lives saved. The calculated return on investment (ROI) of the four policies would be GEL 357 for every GEL invested (UNDP et al. 2018).

Taxes on cigarettes were found to be most cost-effective, among the four interventions studied. Increasing taxes on tobacco to comply with FCTC Art. 6 could avert over GEL 2.2 billion in health care expenses and economic losses over a 15-year period, with a return of GEL 221 for every GEL invested. Expressed differently, taxation could save 13 lives at a cost of GEL 1000. See [Annex 2](#) for methodological details.

Another study by the NCDCPH et al. (2016) uses macroeconomic and customs data and a top-down approach to model the effect on tobacco consumption and revenue collection, of meeting two policy targets of (a) Implementing EU tax regulation (assuming excise duty per cigarette pack at 4.54 GEL minimum), and (b) Reducing smoking prevalence by 2 percent annually (assuming a 2 percent annual drop in volume consumed). Four policy scenarios are considered, based on different time-frames to meet the policy targets. Changes in consumption and revenue collection are estimated based on assumed elasticity parameters (price-elasticity of -0.05 and income elasticity of $.59$) and macroeconomic projections. Results suggest that the scenario with the largest (quickest) annual shocks on excise duties could reduce cigarette consumption by an average of -5.25 percent annually between 2015 and 2020. This scenario would also result in additional tax revenues from excise duties and VAT on cigarettes of GEL 1.4 billion between 2015 and 2020. The study argues that large immediate tax shocks (like those under Scenario 1) seem most adequate to reduce tobacco consumption in Georgia. [Annex 3](#) includes further methodological details.

Price elasticities of demand for tobacco products

Taxes and price policies on tobacco improve health and economic outcomes by inducing consumers to reduce smoking. They require that consumer behavior respond to price changes. Those responses are expressed by the price-elasticities of demand for tobacco. The existing body of evidence suggests that the elasticity of demand among adults lies between 0.3 and 0.8, implying that a 10 percent increase in cigarette prices will lead to a 3 percent to 8 percent decline in consumption (CBO 2012; Chaloupka and Warner 2000; Gallet and List 2003; IARC 2011).

This responsiveness or elasticity of demand to prices is generally expected to decrease with income. Price-elasticities of tobacco can be as low (or inelastic) as -0.4 in high income countries (World Bank 1999), but larger in magnitude—around -0.6 —for low- and middle- income countries (IARC 2011). Lower-income households in a variety of countries also tend to show higher price elasticity of demand relative to medium- and higher-income groups (World Bank 1999). However, the evidence is still mixed in other country cases (IARC 2011). Tobacco elasticities can also be expected to increase in the future, following the argument that today's young generations are more-responsive to price shocks due to lower dependence on nicotine, larger peer effects, or limited disposable income relative to adult smokers (Jha and Peto 2014).

No previous microeconomic empirical estimation of the price-elasticities of tobacco—at the population-level or by income group segmentation—was found in the review of the literature for Georgia. However, some similar exercises have been performed for other countries of the region. The study by Postolovska et al. (2017) in Armenia finds an elasticity of demand for tobacco of -0.54 . Estimated at the decile-level, all results continue to be inelastic, and they decrease with income level (in absolute value). The price elasticity for the poorest quintile is relatively high at -0.74 , while the elasticity for the richest quintile in Armenia drops to -0.28 . In Ukraine, Denisova and Kuznetsova (2014) estimate the national price elasticity of demand at -0.28 . However, decile-specific estimations suggest that the poorest 10 percent of households would reduce their cigarette consumption by 44 percent when faced by a 100 percent price increase. Meanwhile, the wealthiest decile would only react to an equivalent price shock by reducing the quantity of cigarettes consumed by 11 percent. Fuchs and Meneses use the Ukrainian household budget survey 2010-2013 to

further disaggregate price elasticities. They find higher magnitudes of the price elasticities, though they remain inelastic (with a national elasticity of -0.45). Urban households have higher price-elasticities (in absolute value) than rural households, regardless of income level. Consistent with the literature, the authors also find evidence of a negative correlation between age and price-responsiveness. Households that are headed by younger individuals (under age 40) have higher price elasticities (Fuchs and Meneses 2017a).

IV. The ECBA methodology

The extended cost-benefit analysis (ECBA) methodology was developed and applied to several country-studies by Fuchs and Meneses (2017a, 2017b, 2018), based on previous work by Pichón-Riviere et al. (2014) and Verguet et al. (2015). The model aims to empirically account for the different mechanisms—recognized in the literature and summarized in [Figure 1](#) above—that translate increases in tobacco taxes policies to changes in household welfare. Additionally, it allows to test the effects and welfare changes for different income levels, or groups of the population.

Based on this framework, the ECBA empirically estimates the costs and benefits of increasing prices of tobacco following Equation (1). It also estimates decile-specific price-elasticities of demand for cigarettes to test for incidence analysis. By estimating decile-specific price-elasticities, the model recognizes the empirical finding that behavioral responses vary across consumers and income groups. Second, the ECBA model aims to incorporate a comprehensive view of the mechanisms of tobacco taxes discussed in the literature, that result in both costs on household budgets, as well as economic benefits from improving health outcomes. Empirically, the model incorporates three effects:

- (A) The increase in tobacco expenditures faced by households after the tax increase,
- (B) The reduction in direct medical expenses that are averted as households reduce the need for tobacco-related medical treatments, and
- (C) The additional income that households can earn by averting tobacco-related premature deaths, and hence increasing their years of working (or productive life).

The net welfare effect is measured as a change in household incomes, resulting from adding the costs and benefits in components (A), (B) and (C), as described in Equation (1). The distributional incidence analysis then compares the average welfare changes (relative to initial incomes) for the different deciles in the population.

$$\begin{array}{ccccccc}
 \text{Net} & = & \text{Change in} & + & \text{Change in} & + & \text{Change in years} \\
 \text{Income} & & \text{tobacco} & & \text{medical} & & \text{of productive} \\
 \text{Effect} & & \text{expenditure} & & \text{expenses} & & \text{life} \\
 & & \text{(A)} & & \text{(B)} & & \text{(C)} \\
 & & & & & & \text{(1)}
 \end{array}$$

The net effect of increasing tobacco taxes on household income is, hence, dependent on the competing magnitudes of benefits and costs. Ultimately, the overall welfare and distributional impact of changes in tobacco taxation policies will be a function of the price-change; the magnitude and distribution of price-elasticities across income groups; and the initial shares of tobacco consumption in household budgets. Additionally, higher parameters for smoking-related medical expenses (including out-of-pocket expenses) and the preventable years of life lost reflect in higher-magnitude benefits from increasing taxes on tobacco.

A formal description of the model is presented in [Annex 4](#). To the knowledge of the authors, this will be the first empirical estimation of tobacco price elasticities by income-group in Georgia. The following sections describe the data sources used to estimate each parameter and component of the ECBA in the case of Georgia.

V. Price-elasticity of demand for cigarettes

Price-elasticities of demand for cigarettes in Georgia are estimated at the decile level, using data from the Household Integrated Survey (HIS) 2012-2016 and from the Household Income and Expenditure Survey (HIES) in 2017. Several empirical models were tested. The preferred results are plotted in [Figure 2](#). [Annex 5](#) contains the econometric specification, methodological details and relevant robustness checks.

Additionally, lower- and upper-bound elasticity scenarios are simulated with distance of 0.2 from the estimated (base or medium-bound) elasticity in each decile.¹² Following the literature, those scenarios are assumed to represent a shorter- and longer-term outcome, respectively.

Figure 2. Estimation of price-elasticities of demand for filtered cigarettes

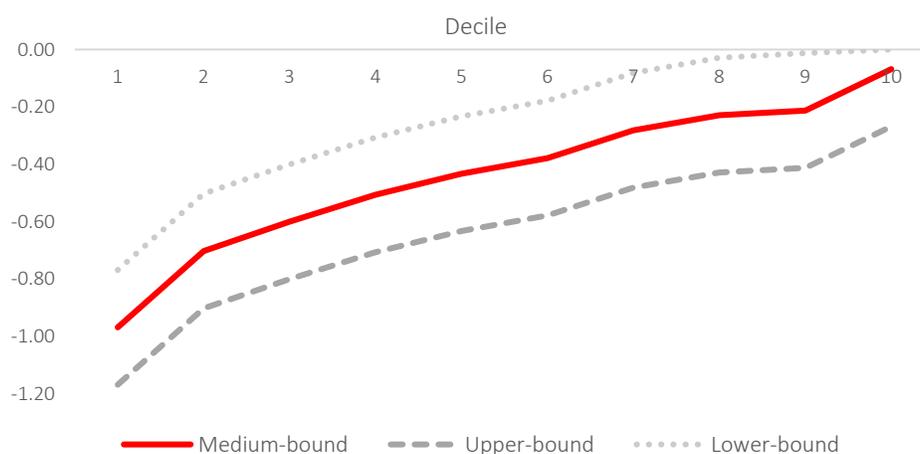


Table 3. Estimation of price-elasticities of demand for filtered cigarettes

Decile	1	2	3	4	5	6	7	8	9	10
Medium-bound	-0.97	-0.70	-0.60	-0.51	-0.43	-0.38	-0.28	-0.23	-0.21	-0.07
Upper-bound	-1.17	-0.90	-0.80	-0.71	-0.63	-0.58	-0.48	-0.43	-0.41	-0.27
Lower-bound	-0.77	-0.50	-0.40	-0.31	-0.23	-0.18	-0.08	-0.03	-0.01	0.00

Source: Authors' estimation based on data from the IHS (2012-2016) and HIES (2017). Notes: Deciles are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. The upper- and lower-bound scenarios were simulated with 0.2 distance from the medium-bound estimation. The lower-bound simulations were capped to avoid positive price elasticities.

¹² Simulating a lower-bound elasticity for decile 10 resulted in a positive value of 0.08. Hence, the upper-bound for this case was intentionally corrected to zero.

The estimation of price-elasticities of demand from household budget surveys can face several empirical challenges. In the absence of price data, the use of unit values to approximate the prices faced by consumers can suffer from simultaneity bias (Deaton 1990; 2018).¹³ If a good is available at different quality grades in the market but prices paid are unobservable, the unit price inferred from household expenditure is a choice variable, reflecting both the consumer’s decision of price, and her decision over quality. In the case of tobacco taxation, this could raise concerns over “quality shredding”, where smokers facing a higher tax could adapt by smoking lower-priced or lower-quality tobacco, rather than reducing smoking. With quality shredding, the elasticity of cigarettes (based on survey data) could overstate smoker responsiveness. The ECBA results could hence overestimate the changes in tobacco expenditure and the sensitivity of indirect effects to a tax reform. This result of quality shredding, however, should be established empirically for each particular commodity and context (Deaton 2018).

The methodology proposed by Deaton (1990) to correct for simultaneity bias is applied as a robustness check to the estimation of price elasticities of demand for cigarettes in Georgia. While the Deaton method has been widely applied to estimate the demand for tobacco products, calculations by income groups are limited. Estimations of own-price elasticities of filtered cigarettes using the Deaton methodology at the tercile- and quintile-level are presented in [Table 4](#) and [Annex 6](#). The overall distributional pattern of elasticities is consistent with the results in [Table 3](#). Lower-income groups of the population are systematically more responsive to price changes in cigarettes. On the other hand, the sensitivity of these Deaton results in Georgia to the model specification calls for deeper investigation (see also Gibson and Kim 2016 and McKelvey 2011 for a discussion on the empirical limitations of the Deaton method).

Table 4. Estimates of price-elasticities of demand for filtered cigarettes, using the Deaton methodology

	1	2	3	4	5
Terciles	-0.62	-0.04	-0.05		
Quintiles	-0.74	-0.40	-0.33	-0.10	-0.27

Source: Authors’ estimation based on data from the IHS (2002-2016) and HIES (2017). *Notes:* Income groups are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. The Deaton method was adapted based on previous applications by Deaton (2018) and Chelwa et al. (2019). Clusters are aggregated at the year, region, and urban-rural level.

VI. Smoking-attributable medical expenses, mortality and YWLL

Tobacco-related medical expenses

The parameter for direct medical expenses from tobacco-attributable diseases in Georgia is taken from the estimations for 192 countries in 2012 by Goodchild et al. (2018). After updating the estimate for changes in the price level, total tobacco-related direct medical expenses are estimated at GEL 80.8 million in 2017. Additionally, taking the national share of out-of-pocket payments in total health care expenses (56 percent, from the WDI), it is estimated that households bear GEL 44.9 million in tobacco-related medical expenses.

¹³ In the common absence of price data from household expenditure surveys, unit values are calculated as household expenditure (amount paid), divided by quantity. To the extent that observations bundle together different goods or quality grades of the same good, unit values differ from prices paid. See Deaton (1990; 2018) for a comprehensive discussion on this issue and the proposed methodology to correct for simultaneity biases.

Some benchmarking suggests that this estimation represents a conservative scenario. Tobacco-attributable medical expenses are much lower than the calculation by the UNDP et al. (2018) of GEL 327.3 million in 2016 reviewed above.

Tobacco-related mortality

Data on smoking-attributable death events in Georgia are taken from the Global Burden of Disease project (GBD 2017). It is estimated that 6,799 people died in Georgia from smoking-attributable causes in 2017 ([Table 5](#)).¹⁴ Ischemic heart disease accounts for over one-third of those deaths. And, consistent with the prevalence rates, 91 percent of smoking-related deaths occur among males.

According to the GBD data, smoking-attributable diseases would be responsible for 13 percent of all premature death in Georgia in 2017.¹⁵ This figure represents a conservative scenario on the health burden of tobacco, relative to previous estimates. The NCDCPH reports that tobacco is the leading cause in cardiovascular disease, cancer and respiratory diseases in Georgia, accounting for up to one-fifth of all premature deaths in the country (NCDCPH et al. 2016).

Years of working life lost (WYLL)

The smoking-attributable years of life lost among the working population (YWLL) in Georgia are calculated based on the mortality data from the GBD (2017). For this calculation, the retirement age is assumed at 65 years old for both males and females.¹⁶ The resulting years of productive life lost at the national level totaled 28,794 years in 2017 ([Table 6](#)).

¹⁴ Includes death events from smoking-attributable causes. The GBD reports smoking-attributable death events only for adults over 30 years old. Deaths related to second-hand smoking and chewing of tobacco are not included.

¹⁵ The overall number of death events reported by the GBD was compared with national records to test consistency. According to Geostat, 50,771 people died in the country in 2016 (Geostat 2016).

¹⁶ Hence, 2,972 smoking-attributable death events for the population between 30 and 64 years old are considered. This is equivalent to only 44 percent of all smoking-attributable deaths. Currently, life expectancy in Georgia is 69 years for males and 78 years for females (WDI 2017). An analysis based on the Labor Force Survey (LFS) 2017 determined that there is not a clear age cut-off in labor force participation in Georgia. (Results are available upon request to the authors.) Hence, the analysis applies the standard assumption of retirement at age 65. This threshold represents a conservative assumption, as the WYLL would be higher (and hence, the effects of taxing tobacco higher) if workers continue earning labor incomes after age 65.

Table 5. Death events attributable to the risk of smoking and other premature deaths, 2017

Disease	Males	Females	All
Aortic aneurysm	76	4	80
Bladder cancer	87	2	89
Chronic obstructive pulmonary disease	472	49	521
Colon and rectum cancer	72	7	78
Ischemic heart disease	2,281	263	2,544
Larynx cancer	131	2	133
Lip and oral cavity cancer	61	3	63
Liver cancer	66	5	70
Lower respiratory infections	133	12	145
Stomach cancer	134	7	142
Stroke	1,067	139	1,206
Tracheal, bronchus, and lung cancer	973	36	1,009
Other attributable	621	97	718
Total attributable	6,175	623	6,799
Non-attributable	19,247	24,518	43,765
All premature deaths	25,422	25,142	50,564

Source: Author's calculations based on 2017 data from the Global Burden of Disease (GDB). Includes death events related with the risk of smoking.

Table 6. Calculation of YLL because of smoking-related deaths, 2017

Age group	Smoking-related death events			Years of productive life lost (YLL)		
	Males	Females	All	Males	Females	All
30 to 34	34	3	37	1,131	86	1,217
35 to 39	74	5	79	2,082	128	2,210
40 to 44	143	9	152	3,286	206	3,492
45 to 49	270	16	286	4,861	285	5,146
50 to 54	505	34	538	6,561	436	6,997
55 to 59	763	56	818	6,101	445	6,546
60 to 64	972	90	1,062	2,917	269	3,186
All < retirement	2,761	211	2,972	26,939	1,854	28,794
All > retirement	3,414	413	3,827			
Total	6,175	623	6,799	26,939	1,854	28,794

Source: Author's calculations based on 2017 data from the Global Burden of Disease (GDB).

Notes: Retirement is assumed at age 65 for males and females. Only death events related to the risk of smoking are considered, other death events related to risks of second-hand smoke and chewing tobacco are excluded.

VII. Household descriptive statistics

[Table 7](#) summarizes basic household demographic and consumption statistics, by decile. Lower-income households are larger, though no clear correlation emerges between income level and age or sex of the household head. Households in the lower-income deciles are also less likely to smoke (proxied by the report of positive consumption of cigarettes). In turn, the wealthiest decile reports the highest smoking prevalence, for all cigarettes and for filtered cigarettes only. On the other hand, lower-income households observe the highest likelihoods of consuming unfiltered cigarettes only ([Table 8](#)).

The expenditure amount on cigarettes (for all cigarettes and filtered cigarettes) increases with income. The value of cigarette purchases among the top 10 percent is more than seven times the value of cigarette consumption by the poorest 10 percent of households. Averaging for all households, all cigarettes take up the largest consumption share in decile two (3.2 percent of aggregate consumption in the decile), though filtered cigarettes are most relevant for middle-income households. However, conditional on smoking, the poorest households spend the largest shares of their budgets on cigarettes (filtered, unfiltered and all cigarettes). These shares decrease consistently with income. The share of all cigarettes for smoking-households in the bottom-10 percent (14.5 percent of household consumption) is more than double the share for smoking-households in the top-10 percent (7.1 percent of their consumption). It is possible to conclude that although wealthier households spend more GEL on cigarettes, those purchases represent much lower tolls on their incomes, than for lower-income households. Poorer households consistently spend more of their scarce resources on tobacco.

Table 7. Household tobacco consumption and total expenditures, 2017

Decile	Population	Household size	Female household head, share of households	Household head age	Household aggregate consumption, annual GEL per capita	Household aggregate consumption, annual USD per capita	Smoker - All cigarettes, percentage	Smoker - Filtered cigarettes, percentage	Expenditure in all cigarettes, annual GEL per capita	Expenditure in all cigarettes, annual USD per capita
1	371,049	4.5	33.1	56.3	640.1	255.0	19.0	10.8	19.1	7.6
2	371,594	4.4	35.3	58.4	1,073.7	427.8	24.5	18.1	35.0	14.0
3	371,737	4.0	31.8	59.3	1,368.6	545.3	25.4	19.1	41.8	16.6
4	371,419	4.0	35.6	60.4	1,660.2	661.4	26.1	21.3	52.5	20.9
5	371,509	3.7	35.5	60.0	1,975.4	787.0	27.6	24.2	64.1	25.5
6	371,100	3.5	36.2	61.0	2,344.2	934.0	28.8	25.6	81.6	32.5
7	371,906	3.3	31.9	59.7	2,772.3	1104.5	29.9	25.9	89.9	35.8
8	371,362	3.2	33.1	59.3	3,339.8	1330.6	30.4	27.7	103.2	41.1
9	371,589	3.0	34.9	57.8	4,266.4	1699.7	27.7	25.5	107.3	42.7
10	371,558	2.5	39.5	55.9	7,896.6	3146.0	31.4	30.4	154.1	61.4
All	3,714,823	3.5	34.9	58.7	2,734.0	1089.2	27.6	23.7	74.9	29.8

Source: Household Income and Expenditure Survey (HIES) 2017 and World Development Indicators (WDI).

Notes: Deciles are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. Households are classified as “smokers” if they report positive expenses in tobacco products. Exchange rate = 2.51 GEL/USD.

Table 8. Household tobacco consumption, 2017

Decile	Smoker Households, percentage			Household budget share in tobacco consumption			Share in household consumption, conditional on smoking		
	All cigarettes	Filtered cigarettes	Unfiltered cigarettes	All cigarettes	Filtered cigarettes	Unfiltered cigarettes	All cigarettes	Filtered cigarettes	Unfiltered cigarettes
1	19.0	10.8	9.9	2.8	1.6	1.1	14.5	15.0	11.5
2	24.5	18.1	7.5	3.2	2.4	0.8	12.9	13.1	10.3
3	25.4	19.1	7.6	2.9	2.3	0.6	11.3	11.8	8.3
4	26.1	21.3	5.7	3.1	2.7	0.4	12.1	12.7	7.8
5	27.6	24.2	4.7	3.1	2.8	0.3	11.2	11.5	6.3
6	28.8	25.6	4.5	3.1	2.8	0.3	10.7	10.9	7.1
7	29.9	25.9	4.4	2.9	2.7	0.3	9.8	10.3	5.7
8	30.4	27.7	3.5	2.9	2.7	0.2	9.5	9.6	6.3
9	27.7	25.5	2.9	2.5	2.4	0.2	9.2	9.3	5.5
10	31.4	30.4	1.5	2.2	2.2	0.1	7.1	7.1	4.2
All	27.6	23.7	4.8	2.8	2.4	0.4	10.3	10.3	7.9

Source: Household Income and Expenditure Survey (HIES) 2017 and World Development Indicators (WDI).

Notes: Deciles are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. Households are classified as “smoker” if they report positive expenses in tobacco products. Conditional shares are calculated only for households reporting positive expenditures on each type of cigarettes.

VIII. Incidence results

Each component of Equation (1) of the ECBA was simulated using data from the IHS 2016, assuming three policy scenarios: 25 percent, 50 percent and 100 percent price increase on all cigarettes. The calculations below also assume that changes in household welfare related to smoking-attributable expenses only affect welfare through out-of-pocket payments.¹⁷ Alternative simulations incorporating the value of total smoking-attributable expenses in the country—as well as imputing other price-elasticity structures—are available in [Annex 7](#). All simulations reflect annual impacts for 2017.

(A) Change in tobacco expenditures

Increasing the prices on tobacco products while holding all other things equal, negatively affects all smoker households, as they are forced to allocate a higher share of their budgets to continue to purchase the same quantities of tobacco. This scenario is known as “direct pass-through” (solid line on [Figures 3](#), Panel A to C), as there are no changes in consumption, and the price-shock on tobacco is passed-through to or absorbed by smokers entirely. Because tobacco purchases represent a higher share of household budgets for lower-income smokers, the direct pass-through effect is regressive, exercising higher damage to poorer smokers.

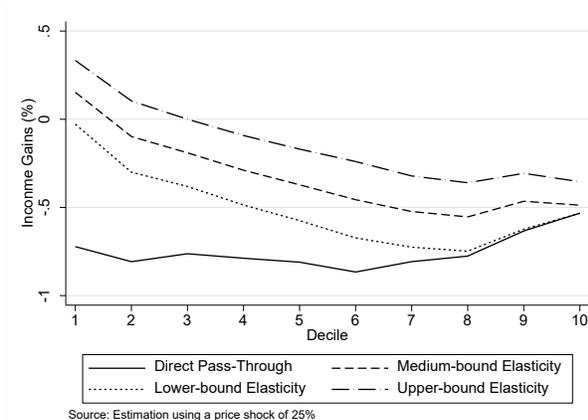
Nonetheless, households adjust consumption when faced with higher prices. As explained above, it is the interaction of the price shock, the price-responsiveness of each group of the population—incorporated as price elasticities—and the share of tobacco in household budgets that determine the change in tobacco expenditures. [Figure 3](#) presents these results with dotted lines for different elasticity assumptions. Assuming a 25 or 50 percent price increase (Panels A and B), the effect is still generally negative and somewhat regressive. Though the magnitude and regressive pattern is more moderate than under direct

¹⁷ The national estimate of smoking-attributable medical expenses (derived from Goodchild et al. 2018) and described above is adjusted by the factor of 56 percent of average out-of-pocket expenditure in medical bills.

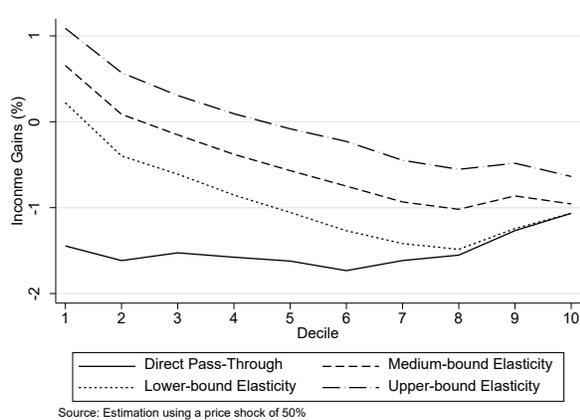
passthrough (and decreasing with elasticity). For larger elasticities and price shocks (e.g. upper-bound elasticities in Panel C), the positive and progressive price effects illustrate that as tobacco becomes more unaffordable, households cut down on tobacco consumption enough to “free up” budget resources for other uses. Disposable income is higher after the tax increase. Because lower-income households observe the largest shifts away from tobacco, the pattern becomes progressive.

Figure 3. Change in tobacco expenditures after increasing taxes

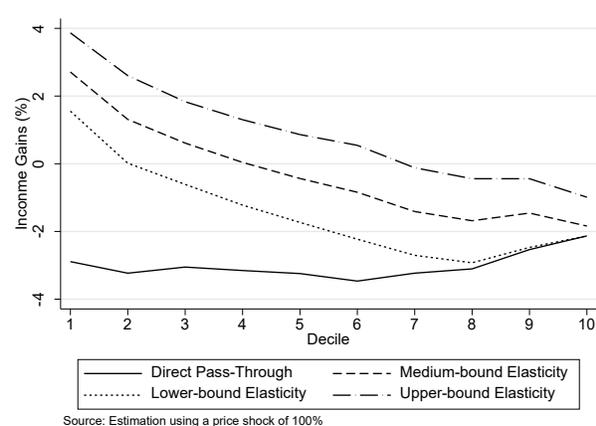
Panel A. 25% Price increase



Panel B. 50% Price increase



Panel C. 100% Price increase



Source: Author estimations, based on the IHS 2012-2016 and HIES 2017. Notes: Deciles are created based on per capita household consumption.

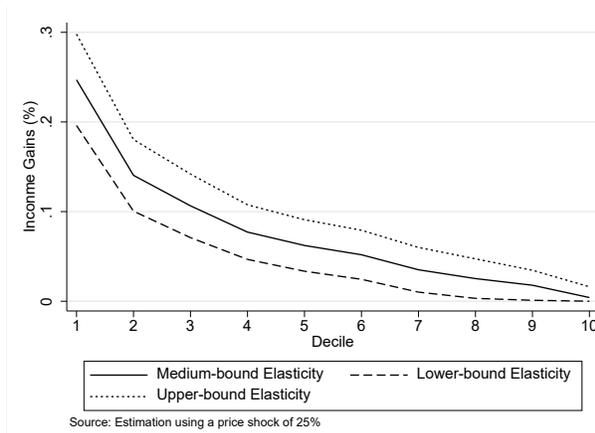
(B) Reduced Medical Expenses

Figure 4 plots the effects of reducing out-of-pocket medical expenses after the tax-induced price increase in cigarettes. This mechanism yields positive income gains for all deciles, as the price shock encourages a reduction in smoking, and hence, a drop of tobacco-related medical expenses. Households can then benefit from higher disposable income, as they are no longer burdened by those medical bills. Moreover, the combination of high smoking prevalence and high sensitivity (elasticity) to price changes among lower-income households results in a progressive relative incidence. The magnitudes of these benefits are large for the lower-income deciles. Assuming a price shock of 50 percent, on average, the long-term reduction

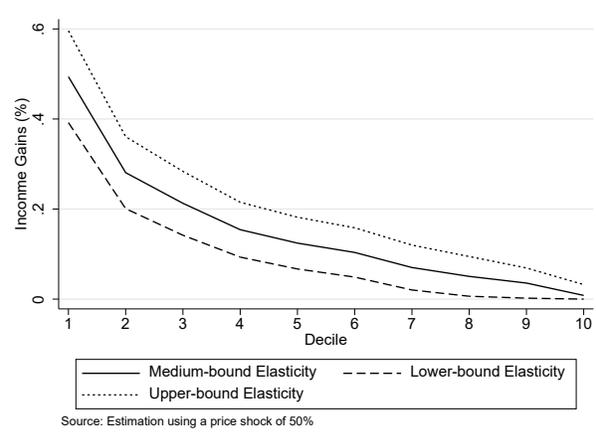
in out-of-pocket tobacco-related medical expenses could represent 0.5 percent of household income for the poorest 10 percent of the population.¹⁸

Figure 4. Effect of reducing medical expenses

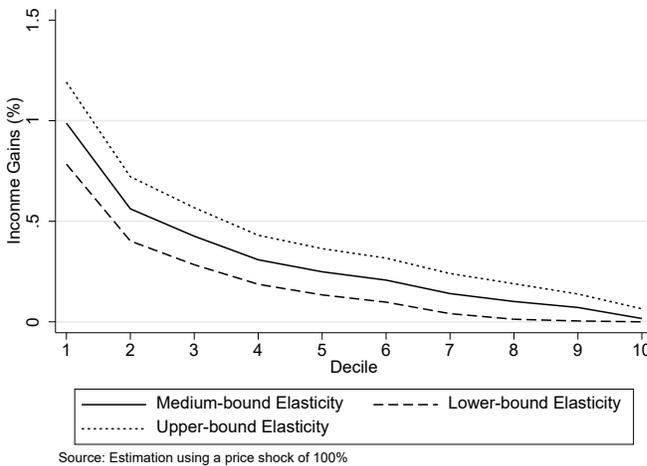
Panel A. 25% Price increase



Panel B. 50% Price increase



Panel C. 100% Price increase



Source: Author estimations, based on the IHS 2012-2016, HIES (2017), Goodchild et. al (2018) and WDI (2017). Notes: Only out-of-pocket tobacco-related medical expenses are considered. Deciles are created based on per capita household consumption.

(C) Change in productive Years of Life Lost (YLL)

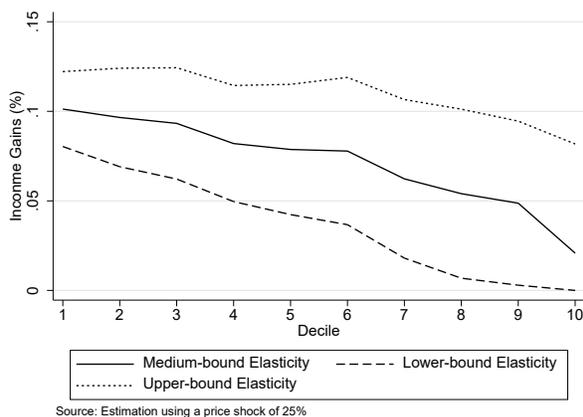
Panels A to C of [Figure 5](#) show the additional share of income that households could gain as labor incomes, after the tobacco tax increase results in lower years of life lost. Compared to other country applications of the ECBA, these results seem more progressive. This distributional pattern is mainly driven by the high variance in price elasticities across deciles, and the price-responsiveness among lower-income households

¹⁸ Following standard tax incidence analysis, Figures 2 to 6 plot the average income change for each decile. This average, however, considers both smoker and non-smoker households in the decile, e.g. those who spend on tobacco and suffer the direct negative consequences of smoking, and those with zero expenditures on tobacco and no direct income losses from smoking (assuming no externalities or spill-over effects, and no form of fiscal cross-subsidy to smokers). The impact on households with smokers (relative to their own income level) would be higher than this average effect.

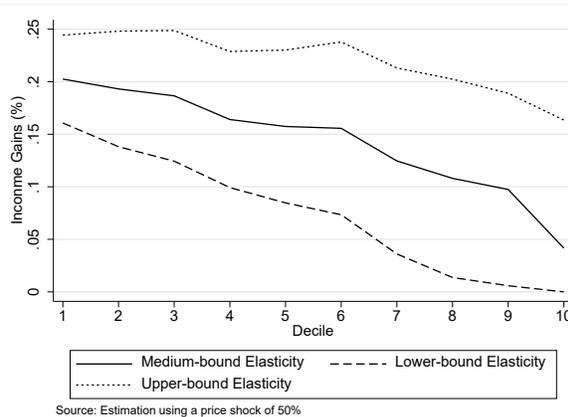
in Georgia. However, as compared to decreasing the tobacco-related medical expenses, reducing the productive YLL yields much lower welfare gains for all households.

Figure 5. Effect of reducing the years of productive life lost

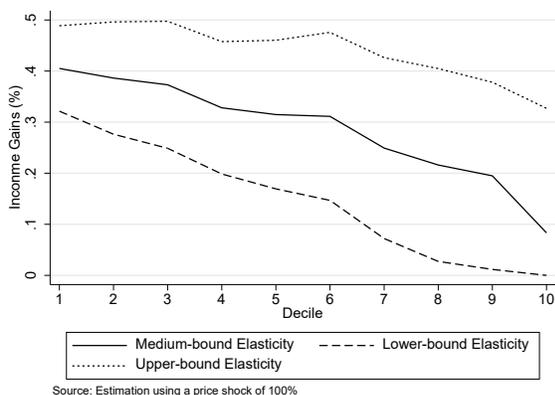
Panel A. 25% Price increase



Panel B. 50% Price increase



Panel C. 100% Price increase



Source: Author estimations, based on the IHS 2012-2016 and HIES 2017. Data on smoking-attributable death events is taken from the GBD (2017). Notes: Deciles are created based on per capita household total consumption.

Net income effect

The net income effect of increasing taxes on cigarettes in Georgia (Figure 6) is calculated by adding the individual cost and benefit components (A) to (C), according to Equation 1. Across all price simulations, the net distributional effect of increasing these taxes is highly progressive. Lower-income households consistently receive higher benefits, relative to their income, than wealthier peers.

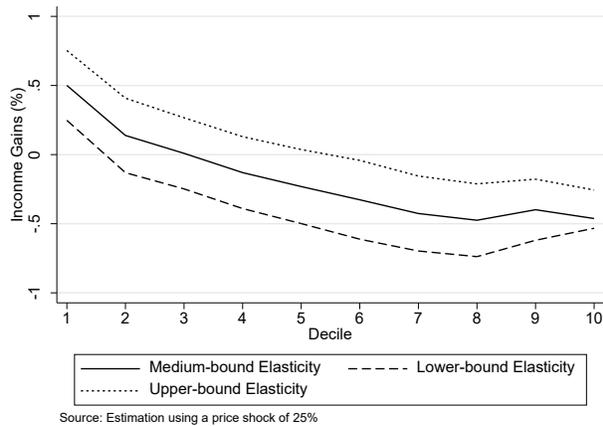
Moreover, increasing taxes on tobacco could be simultaneously pro-poor and growth-enhancing. Under all price and elasticity scenarios, the benefits outweigh the costs, resulting in net positive effects for significantly large sectors of the population, and most importantly, for the poor. Even under the most

conservative simulation (Panel A with 25 percent price shock and short-term or lower-bound elasticity), the bottom 20 percent of the income distribution would observe positive income gains.¹⁹

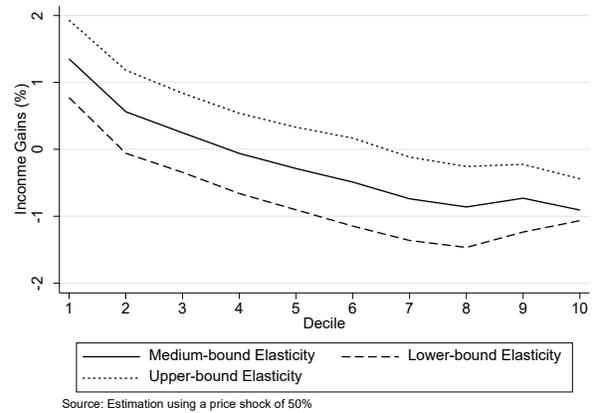
Those gains naturally increase with the magnitude of the price shock. Panel C shows that under the most optimistic simulations, increasing taxes on tobacco can have high long-term income benefits for the poor and vulnerable households in Georgia. In the medium- to long-term, the simulated magnitude lies between 5 and 6 percent of net income gains for the poorest decile, assuming a 100 percent price increase in cigarettes. This suggests that taxes on tobacco should be considered seriously in Georgia, as a cost-effective policy in both the public health agenda, and the poverty reduction efforts.

Figure 6. Net income effect

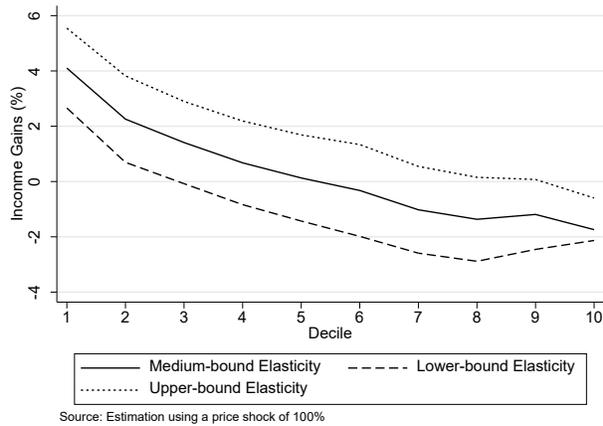
Panel A. 25% Price increase



Panel B. 50% Price increase



Panel C. 100% Price increase



Source: Author estimations, based on the IHS 2012-2016 and HIES 2017. Data on smoking-attributable death events is taken from the GBD (2017), and tobacco-related out-of-pocket medical expenses (adapted from Goodchild et al. 2018 and WDI).

Notes: Deciles are created based on per capita household total consumption.

¹⁹ The effect for the third decile is also positive, though close to zero.

Figure A7.1 in the Annex presents similar results, accounting for the reduction in total tobacco-related medical expenses (including out-of-pocket, as well as public and other private expenses). The long-term value (upper-bound scenario) of increasing the price of cigarettes by 50 percent can exceed 2 percent of income for the bottom 10 percent of the population.

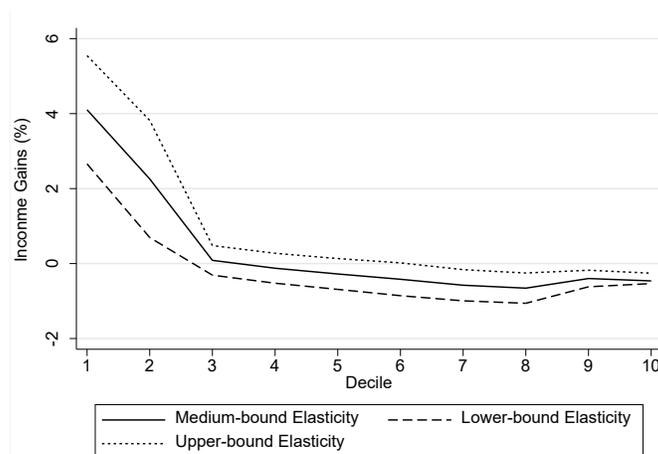
Heterogenous effect of increasing the specific excise

The two major types of special taxes that countries impose on tobacco are *specific* (quantity-based) and *ad valorem* (value-based) excise taxes. While both schemes have strengths and drawbacks, the literature and international experiences suggest that a *specific* excise tax is often “technically superior” (Marquez and Moreno-Dodson 2017). Implementing a *specific* excise can lower administrative burdens, the risks of non-compliance, and the incentives for the tobacco industry to keep consumer prices low (Ibidem).

Additionally, raising the specific tax may bring further distributional considerations. If poor households consume lower-priced cigarettes, augmenting the price of all cigarettes by a specific amount will translate to a higher price shock for poor households. To test this scenario in the case of Georgia, consumption prices are analyzed for different brands in the tobacco market. The available tobacco price data for 2014 suggest that a pack of 20 cigarettes was 3.2 GEL for the premium brand, and 2.2 for the most sold brand. However, the cheapest brand was only 80 tetri per pack (WHO 2015). A hypothetical price shock is simulated, assuming that those price ratios are held, and that smokers in the 20 poorest percent of the population purchase the cheapest brand only, while smokers in the two wealthiest deciles consume premium brands only. The rest of the population is assumed to smoke the most sold brand. The simulated price shock is also calibrated to achieve comparability to a 50 percent price shock. Hence, it is assumed that deciles I and II face a 100 percent price shock, deciles III through VIII are affected by a 36 percent price increase, and deciles IX and X observe a 25 percent price rise in cigarettes. The average price shock across all deciles is 47 percent.

As Figure 7 shows, the implementation of a *specific* tax increase results in a much more progressive distribution of the benefits of tobacco taxes in Georgia, relative to a similar *ad valorem* increase. The bottom 20 percent of the population can increase their average income by 3 percent in the medium- and long-term, thanks to the extended benefits of tobacco taxes.

Figure 7. Net income effect under specific excise increase



Source: Author estimations, based on the IHS (2012-2016) and HIES (2017). Data on smoking-attributable death events is taken from the GBD (2017), and tobacco-related medical expenses adapted from Goodchild et al. (2018) and WDI.

Notes: Estimation using a price shock of 100% for deciles 1 to 2, 36% for deciles 3 to 8, and 25% for deciles 9 and 10.

Deciles are created based on per capita household total consumption. Only out-of-pocket medical expenses are considered.

IX. Welfare simulations

The net income gains from increasing taxes on tobacco could contribute to poverty reduction efforts in Georgia. [Table 9](#) shows the simulated reductions in the number of poor people in 2017, based on international poverty lines (US\$1.90 and US\$3.20 per capita per day, PPP 2011). Using the more relevant poverty measure for Georgia—the lower middle income class poverty line of US\$3.20 PPP—and considering only out-of-pocket medical expenses, a 50 percent increase in the price of cigarettes could have reduced poverty by 4.2 thousand people in 2017. Implementing an equivalent *specific* excise tax (assuming scenario c) could have lifted close to 7 thousand Georgians out-of-poverty in the same year. These projected reductions in poverty are only indicative of potential improvements in household welfare resulting from the tax increase in isolation. Additional channeling of tobacco revenues to poor households or improved government funding for health and social programs could reduce poverty further.

Table 9. Simulated changes in poverty, 2017

Simulated scenario		Reduction in number of poor people, by international poverty line		
		US\$1.90 PPP/day	US\$3.20 PPP/day	
	Cigarette price increase	Smoking-related medical expenses		
(a)	50 percent uniform price increase	Out-of-pocket only	1,781	4,210
(b)	50 percent uniform price increase	All medical expenses	4,276	5,750
(c)	Heterogenous price increase (average 47 percent) *	Out-of-pocket only	5,600	6,924

Source: Author estimations with results from section VIII, based on data from the IHS 2012-2016, HIES 2017, GBD (2016), Goodchild et al. (2018) and WDI. Note: *Estimation using a price shock of 100% for deciles 1 to 2, 36% for deciles 3 to 8, and 25% for deciles 9 and 10.

X. Discussion

The negative health and economic consequences of smoking are a major policy concern in Georgia. In a context of demographic pressures, high public and private expenses in of the health care system, and efforts to maintain fiscal balance (World Bank 2018a), tobacco consumption generates high social and economic burdens. By reducing the consumption of tobacco, individuals observe health benefits, that translate—among many other benefits—to reductions in medical expenses and in the years of productive life that would be lost due to smoking-related premature deaths. This paper uses empirical estimations of the price elasticities of demand by income decile and applies the extended-cost benefit analysis model to account for those—often disregarded—economic benefits of tobacco taxation in the case of Georgia. Different price-shocks and elasticity scenarios are simulated, to grasp on the short-, medium- and long-term effects of a tobacco tax reform.

The results contribute to the international evidence that increasing taxes on tobacco can bring significant welfare and equity benefits. In contrast to a naïve (complete pass-through) estimation that neglects the behavioral response of smokers to price changes—and consistent with extensive evidence for other countries—the results confirm that lower-income households in Georgia have higher price elasticities of

demand for tobacco. Hence, they can benefit from the highest relative benefits in reduced medical bills and years of productive life lost, that work to offset potential welfare losses from increased tax liabilities. In sum, the net distributional effect of increasing taxes on tobacco in Georgia is not regressive, but rather progressive. Accounting for both costs and extended benefits, there are net positive income gains for the bottom 20 percent of the Georgian population, under all tax scenarios considered. Under the more ambitious tax increase, half of the population could potentially receive net income benefits.

Two characteristics of the distribution of price-elasticities contribute to these results in Georgia. First, the price-elasticities of tobacco are particularly high among lower-income households. Second, higher-income smokers are expected to change their tobacco consumption patterns only marginally. The price-elasticity for decile ten is close to zero. While this contributes to the observed progressive incidence of the tobacco tax, it also raises public health and financial concerns. There is urgent need to further understand the driving forces reflected in these patterns, and to introduce complementing policy responses to target these non-responsive consumers.

Another interesting discussion arises on the highly progressive effect of *specific* excise taxes (relative to an *ad valorem* equivalent). Implementing a *specific* tax increase can yield highly progressive net effects, as smokers of low-priced tobacco (assumed to be those with lower incomes) face higher price shocks. Overall, the results suggest that there is little to lose and much to gain from increasing taxes on tobacco in Georgia. In addition to progressive tax incidence, the net benefits of taxing cigarettes are positive for large sectors of the population. In 2017, those positive income gains could have reduced poverty for 4 to 7 thousand Georgians in 2017, under the analyzed policy scenarios. These results are a lower-bound estimate, as they consider out-of-pocket medical expenses only, and leave out other possibilities to reduce poverty through enhanced fiscal revenues and reduced public outlays on tobacco-related diseases.

However, the theoretical framework and decomposition of the ECBA also warn about possible short-term negative consequences on some poor and vulnerable smokers, who may be overburdened by a disproportionate price increase on their budgets, while they manage to reduce smoking. For example, some households who live out of poverty—but close to the poverty line—could still be vulnerable to income fluctuations and to fiscal impoverishment if taxes on tobacco are raised but smokers do not adjust their consumption behavior. Policy should accompany tax increases with complementing interventions to facilitate behavioral adjustments—to induce and assist smokers to quit tobacco—and to cushion temporary income shocks. As smokers quit and price elasticities increase in the medium- to long-term, the health and economic benefits of tobacco taxes expressed in the ECBA can be expected to offset those transitional income losses.

There are possible improvements to this empirical application of the ECBA in Georgia. First, it is often argued that the calculation of price-elasticities of demand from household survey data—which generally, as in the case of Georgia, omit price information—fails to account for quality shredding and substitution effects. This would be a source of concern to the extent that smokers in Georgia switch consumption to lower-price tobacco when faced by a price increase. The estimations of own-price elasticities of filtered cigarettes adapting the Deaton methodology (Deaton 1990; 2018) show a negative correlation of household incomes and their sensitivity to price changes in tobacco. Despite some potential quality shredding, consumers reduce overall cigarette consumption when faced with higher prices. Moreover, lower-income groups of the population are systematically more responsive to price changes in cigarettes. Smokers from poorer households in Georgia are more likely to adjust consumption, and to benefit most from the medium- and long-term benefits of reduced smoking. On the other hand, results from the application of the Deaton method are sensitive to model specifications, and better data and further analysis is required to better understand substitution and cross-elasticities of demand with other types of tobacco

products. In any case, supporting policies to enhance the impact of tobacco taxation should include efforts to ensure effective tax administration, and to prevent smuggling and other potential sources of cheaper substitutes of tobacco products.²⁰

Finally, the benefits found in these simulations should be added to other positive outcomes of investing additional revenue collection on health and social programs. And several other benefits of reducing smoking are not included in the calculations. For example, the consequences of secondhand smoking are not considered, and other studies have estimated the indirect costs at the workplace—including excess absenteeism, presenteeism and smoking breaks—at 394 million in Georgia, three times as much as the costs of premature mortality and disability or 48 percent of the total annual economic costs of cigarette consumption in 2016 (UNDP et al. 2018). The intrinsic value of the human lives saved, and the improvements in the health and quality of life of smokers and their family members are difficult to quantify but cannot be overstated.

²⁰ For the discussion on another commonly cited argument by the tobacco industry against taxes on tobacco—the potential increase in illicit trade—see Little et al. 2019. The authors find that provided “the tax administration remains strong and vigilant, policy-makers in Georgia do not have to worry that the planned increases in tobacco excise taxes will result in a massive influx of illicit cigarettes to the market.”

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Annex

Annex 1. The 2017 reform on tobacco-control legislation

Policy	Description
Ban of smoking in enclosed public places, enclosed workplaces and public vehicles	Bans smoking (including e-cigarettes and hookah) in all public transport and buildings, but excludes prisons, casinos and taxis.
Ban of all forms of advertisement, sponsorship and promotion	Includes the prohibition to display at sales-points and the restriction to show tobacco products in movies and mass performances. Applies to tobacco products and accessories and devices for tobacco use.
Standardized cigarette packaging	Introduction of regulations for plain packaging of cigarettes.
Improved health warnings	Increase in the size of health warnings to 65 percent of cigarette packaging and requirement of pictorial warnings on front side of the packages.
Industry non-interference	Prohibition on the direct or indirect participation of the tobacco industry in decision-making on health policy.
New model for enforcement	Higher fines for violations of tobacco-control regulations, and increased burden of responsibility on businesses and organizations, with no court decision needed.
Other provisions	Includes the classification of e-cigarettes containing nicotine as tobacco products; fines on smoking while driving; and a ban on tobacco retail sales through the internet and mail.

Source: Based on WHO 2018.

Annex 2. Methodology of the UNDP et al. (2018) study on the effects of tobacco-control policies

- The study by the UNDP and the WHO estimates the economic costs and benefits of implementing four WHO-FCTC priority tobacco control policies in Georgia, as well as the government’s commitment to a 2% annual reduction in smoking. Four tobacco-control policies are considered:
 - Increasing taxes on tobacco to reduce affordability (FCTC Art. 6)
 - Ban on indoor smoking in public places (FCTC Art. 8)
 - WHO-FCTC recommended labelling and packing standards (FCTC Art. 11)
 - Bans on tobacco advertising, sponsorship and promotion (FCTC Art. 13)

Data sources and assumptions

- Data were collected from national sources and the Global Burden of Disease (GBD).
- Five methodological steps were followed.

Step 1. Estimate tobacco-related mortality and morbidity. Data from GBD on 27 diseases and conditions.

Step 2. Estimate tobacco-related total economic (direct and indirect) costs as:

- **Direct costs from tobacco-attributable health care expenditures.** A smoking-attributable fraction (SAF) is assumed at 8.1 percent of health expenditures. Tobacco-related expenses are estimated under a “crude, top-down approach”, by multiplying the SAF times the total health care expenditures in Georgia.
- **Indirect costs of tobacco include:**
 - (a) Costs of tobacco-related premature mortality [valued at GDP per capita], and
 - (b) Costs of smoking in the work place: (b.1) Excess absenteeism: estimated at 2.6 days per year missed due to active smoking; (b.2) Excess presenteeism: estimated at 1% average loss of productivity per year, among active smokers; (b.3) Yearly working days lost because of smoking breaks [assumption not clear from the document].

Step 3. Estimate the effect of each intervention on mortality, morbidity and total economic costs, based on a parameter of its effect on tobacco prevalence. The reductions in tobacco prevalence attributed to each intervention are taken from the SimSmoke model by the WHO.

Assumed change in tobacco prevalence from raising taxes on cigarettes in Georgia

Intervention	Relative change in smoking prevalence: First 5 years	Relative change in smoking prevalence: Years 6-15	Relative change in smoking prevalence: Years 6-15
Raise cigarette taxes (FCTC Art. 6)	-18.2%	-9.1%	-27.3%
All interventions combined	-33.0%	-12.4%	-45.4%

Source: UNDP et al. 2018.

Marginal effects are calculated for each intervention, with respect to a base model (no intervention). The effects of reducing prevalence from each intervention is estimated for (i) lives saved, and (ii) savings in the economic costs.

Step 4. Estimate the financial implementation costs for each intervention, as well as the four interventions together. The financial costs for implementing each intervention are obtained (specifically for Georgia) from the WHO Costing Tool for Prevention and Control of Noncommunicable Diseases and adjusted for inflation.

Assumed financial costs of raising taxes on cigarettes in Georgia

Intervention	Estimated Intervention Cost First 5 years (Mn)	Estimated intervention costs after 15 years (Mn)
Raise cigarette taxes (FCTC Art. 6)	GEL 1	GEL 2.5
All interventions combined	GEL 4	GEL 10

Source: UNDP et al. 2018.

Step 5. Quantify returns on investment (ROI) ratios for each policy and the four policies together.

Main results

- Results suggest that the total costs of tobacco in Georgia amount to GEL 824.9 million in 2016 (2.43% of GDP), including:
 - GEL 327.3 million in direct health care expenditures (cumulative of GEL 4.9 billion in 15 years).
 - GEL 497.5 million in indirect economic losses due to premature mortality, disability, and workplace costs (cumulative of GEL 2.5 billion in 5 years, and 7.5 billion in 15 years).
- The economic (indirect) losses make up 60 percent of the total tobacco burden.
- The benefits from the four interventions far out-weight the financial costs over 5 and 15-year periods.
 - Full implementation and enforcement of the four interventions could avert GEL 3.6 billion in health care and economic losses over 15 years (Including 1.4 billion in direct health care expenses and GEL 2.2 billion in economic productivity).
 - The calculated return on investment (ROI) of GEL 357 over every GEL 1 invested.
- Together, the interventions could save 53,110 lives over a 15-year period, at a financial cost of GEL 1000 per 5.3 lives saved.
- Taxes on cigarettes are found to be the most cost-effective intervention.
 - Taxes could avert over GEL 2.2 billion in health care expenses and economic losses over a 15-years period, with a return of GEL 221 for every GEL invested.
 - Taxation is the most cost-effective intervention to save lives (saving 13 lives at a cost of GEL 1000), while smoke-free policies show the highest financial cost per life saved.

Annex 3. Study by the NCDCPH et al. on tobacco taxation (2016)

A study by the National Center for Disease Control and Public Health uses a top-down approach to model the effect on tobacco consumption and revenue collection of introducing (a) the EU-tobacco taxation targets, and (b) the national target to reduce smoking by 2 percent annually (NCDCPH et al 2016).

Data sources and assumptions

- **[Supply-side] Total quantity of cigarettes (2005-2014).** To calculate the quantity of cigarettes consumed, the study uses (a) volumes of imported filtered cigarettes (as reported by customs authorities), plus (b) volumes of domestically-produced tobacco sales (quantities are inferred from excise tax declarations).²¹ No smuggling (in or out of Georgia) and zero stocks are assumed. Possible smuggling of tobacco, and informal purchases of domestic cigarettes (not subject to the excise tax) are not observed. The study recognizes a possible overestimation bias of consumption under this methodology. The resulting quantities consumed exceed (by three- to six-times) data by Geostat.
- **Average retail price.** Data on the retail prices of (local and imported) filtered cigarettes were provided by Geostat (2005-2014). The average retail price was weighted by the shares of local and imported cigarettes in consumption. In 2015, the average retail price was based on data from the MoF.
- **Average tax rates.** Average excise rates were weighted by consumption volumes of imported and locally-produced tobacco products. *Ad valorem* excise taxes were assumed at 10% after 2016.
- **Price elasticity.** Lacking an empirical estimation of price-elasticities of tobacco in Georgia, the study assumes a single elasticity for the medium brand cigarette of -0.5, as recommended in the WHO Tobacco Tax Simulation Model (WHO Tobacco Tax Simulation Model (June 2013).
- **Income elasticity.** Using historical data on tobacco consumption and private disposable income (PDI) for 2005-2014, a time-series regression estimates the effect of increasing PDI on tobacco consumption. The implied income elasticity is calculated at .59. The study recognizes a possible over-estimation bias in this parameter.
- **Complete pass-through.** The model assumes that a tax increase is completely passed-through to consumer prices. It is also assumed that producers' price increases with inflation and real GDP growth.
- **Macroeconomic projections.** Forecasts of GDP, PDI and consumer prices index are based on data by the MoF for 2015-2019. The same 2019 growth rates are assumed for 2020-2025. The GEL to EUR exchange rate is assumed fixed at the 2015 rate (1 Euro=2.52 GEL).

The model

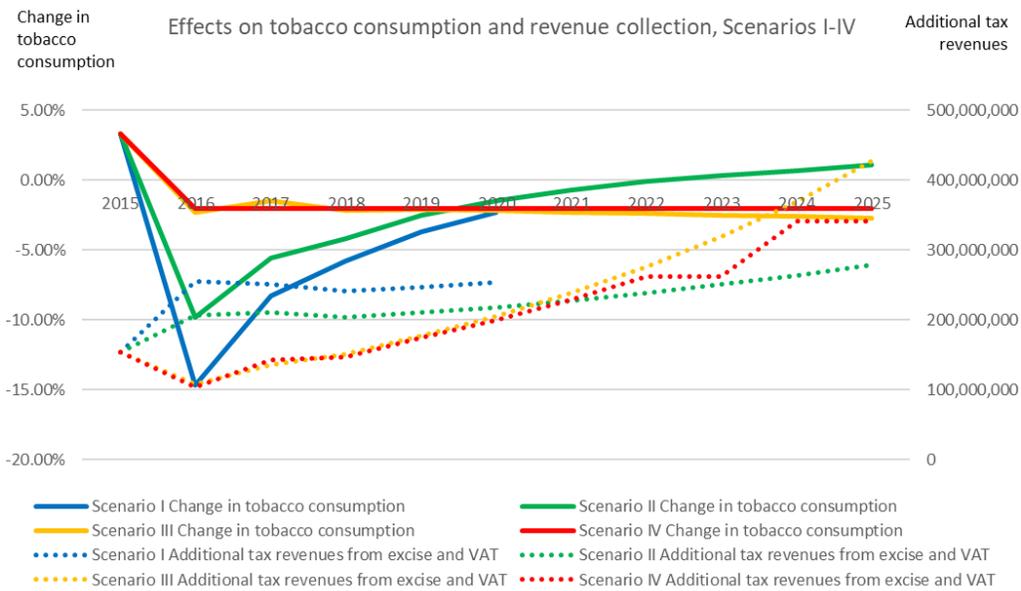
- The model estimates the effect of meeting two policy targets:
 - (a) **Target: EU regulation.** Total excise duty per pack of cigarettes is assumed at minimum of 4.54 GEL.
 - (b) **Target: 2% annual reduction in prevalence.** A decrease of 2% in annual volumes consumed is assumed.
- Four scenarios are built based on those targets:
 - I. Increase of total excise tax by equal amounts so that EU requirements are met in 2020.
 - II. Increase of total excise tax by equal amounts so that EU requirements are met in 2025.
 - III. Fixed growth rate of total excise tax, so that EU requirements are met in 2025.
 - IV. Increase of total excise tax to achieve 2% annual reduction in tobacco consumption (10-year plan)
- For each scenario, the methodology follows the steps:
 - (1) Estimate the total excise tax.
 - (2) Calculate average tobacco sales prices for each year. Prices increase with the excise tax and VAT, as well as inflation and GDP growth.

²¹ Domestically-produced cigarettes are taxed with excise duties at the time of supply to the final consumer, or at the pick-up time from warehouse facilities for sales purposes (NCDCPH et al. 2016).

- (3) Calculate average yearly tobacco consumption, by applying the price and income elasticities and the changes in sales prices and PDI.
- (4) Calculate the average collection of tax revenue.

Main results

- Results for the four scenarios are plotted below.
- The study argues that Scenario I could be the most ideal, as it increases the excise duty by larger shocks, hence contributing to the ultimate policy objective to reduce tobacco consumption and minimizing the risks that consumers can adapt to small price increases without changing demand.
- However, it cautions on the risks that rapid tax increases could foster smuggling (and potentially reduce revenue collection consequently).



Source: Based on results from NCDCPH et al. 2016. Year 2014 is not shown.

Annex 4. Methodology to calculate each component of the ECBA

This Annex provides a formal description of the components of the Extended Cost Benefit Analysis (ECBA) methodology. Different ECBA models have been applied in the health literature to estimate the effects of tobacco on health and economic outcomes. This interpretation of the ECBA was developed by Fuchs and Meneses (2017a, 2017b, 2018) with an emphasis on empirical applications to household survey data. The reader should refer to the original work by Pichón-Riviere et al. (2014) and Verguet et al. (2015) for further methodological details.

A partial equilibrium approach is taken to simulate the impact on household welfare, from an increase in the price of the tobacco product. The model evaluates the first-order effects of a change in prices, relying on the empirical estimation of price-elasticities of demand (at the level of income-deciles) to simulate consumer behavioral responses. The reduction in the quantity of tobacco consumption is estimated at the decile level (as opposed to traditional estimations aggregated at the country-level) and assumed to have a direct effect on people's health outcomes.²²

The net effect on household welfare due to the change in the price of tobacco ($\Delta W_{t,i}$) is simply calculated by adding the costs and benefits captured in components (a), (b) and (c). Further details on the calculation of each component are presented below.

$$\Delta W_{t,i} = \Delta \omega_{t,i} + \Delta MedExp_{t,i} + \Delta YWLL_{t,i} \quad (1)$$

The net effect of increasing tobacco taxes on household income is, hence, dependent on the competing magnitudes of benefits and costs. Ultimately, the overall welfare and distributional impact of changes in tobacco taxation policies will be a function of the price-change (ΔP_t), the magnitude and distribution of price-elasticities across income groups (ϵ_d), the initial shares of tobacco consumption in household budgets ($w_{t,i}$), and the negative health effects of tobacco that reflect in preventable medical expenses ($Med_{t,i}$) and premature years of life lost ($YWLL_{t,i}$).

$$\Delta W_{t,i} = f(\Delta P_t, \epsilon_d, \omega_{t,i,d}^0, YWLL_{t,i}, Med_{t,i}) \quad (2)$$

Empirically, to obtain the distributional incidence, the effects are averaged over deciles, and presented relative to each decile's average income. Household aggregate consumption from the household budget survey is assumed to equal household income.

Consumer behavioral responses

The reduction in the quantity of tobacco consumption ($\Delta q_{t,d}$) is estimated for households in decile d , after a price increase Δp_t in tobacco.

$$\Delta q_{t,d} = \Delta p_t * \epsilon_d$$

A direct pass-through scenario—where behavioral responses are ignored, and household entirely absorb the price-shock—fits into the model as the case with $\epsilon_d = 0$.

²² The model assumes that the health effects of tobacco-related diseases will immediately diminish with the reduction in tobacco consumption. Even though this assumption is implausible in the short term because changes in the effects of tobacco-related diseases take time to materialize, it provides an upper-bound estimate of the effects of tax increases.

Change in tobacco expenditures (A)

The direct effect of increasing prices on the tobacco product (t) for household (i) in decile (d) is calculated as:

$$\text{Change in Tobacco Expenditures: } \Delta w_{t,i,d} = (1 - (1 + \Delta p_t) * (1 + \Delta p_t * \epsilon_d)) * \omega_{t,i,d}^0 \quad (a)$$

Where $\omega_{t,i,d}^0$ expresses the initial (pre-tax) budget share of tobacco expenditures in total household i consumption. For the distributional incidence analysis, $\Delta \omega_{t,i,d}$ is averaged by decile.

Change in medical expenditures (B)

The change in medical expenditures associated with tobacco-related diseases is estimated as:

$$\text{Change in Medical Expenses: } \Delta MedExp_{t,i} = (\Delta p_t * \epsilon_d) * \frac{\text{Cost Treatment}_{t,i}}{W_i^0} \quad (b)$$

Where $\text{Cost Treatment}_{t,i}$ are the costs of medical treatment due to tobacco-attributable diseases affecting household i , and W_i^0 is the household's total consumption. Empirically, the national estimates of treatment costs are distributed across deciles d proportionally to the share of all households that consume tobacco in the population.

Change in the years of working life lost (C)

The model incorporates the impact of tobacco-related mortality on household welfare by accounting for the forgone earnings due to smoking-attributable premature deaths.²³

$$\text{Change in income from YWLL: } \Delta YWLL_{t,i} = (\Delta p_t * \epsilon_d) * \frac{YWLL_{t,i} * I_i}{W_{i,d}^0}$$

Households can benefit from higher earnings (or rather lower forgone incomes) by cutting smoking as a reaction to the price increase. The benefit for each household arises from the tax-induced reduction in smoking ($\Delta p_t * \epsilon_d = \Delta q_{t,d}$) and the potential earnings (I_i) that would accumulate over the course of the additional years of productive life (which mirror the years of life lost because of tobacco-attributable premature deaths, $YWLL_{t,i}$).

The $YWLL_{t,i}$ are distributed across deciles d proportionally to the share of all households that consume tobacco in the population.

²³ This approach does not attempt to account for the value of the lives lost to tobacco-related diseases. Exercises to impute an economic value to those lives face a variety of methodological caveats in the literature (see Lightwood et al. 2000 for a discussion). The proposed ECBA takes the more modest YLL approach to capture the labor income flows that households lose due to tobacco illnesses. The overall impact of the lives lost on society's welfare and well-being would be much higher and difficult to calculate.

Annex 5. Estimation of price elasticities of tobacco

Econometric model

Let $Q_{t,i,d}$ be defined as the average quantity of cigarettes boxes smoked in the current year by household i in income decile d ; $P_{t,i,d}$ is the average price per cigarette box (unit value) faced by household i ; D_i is a vector of ten indicator variables (equal to 1 only for the consumption decile of household i , and zero otherwise); and $X_{i,d}$ a vector of sociodemographic characteristics of i . Then, the smoking intensity equation can be written as:

$$\ln Q_{t,i,d} = \beta_0 + \beta_d \ln P_{t,i,d} * D_i + \beta_3 X_{i,d} + \mu_{id} \quad (2)$$

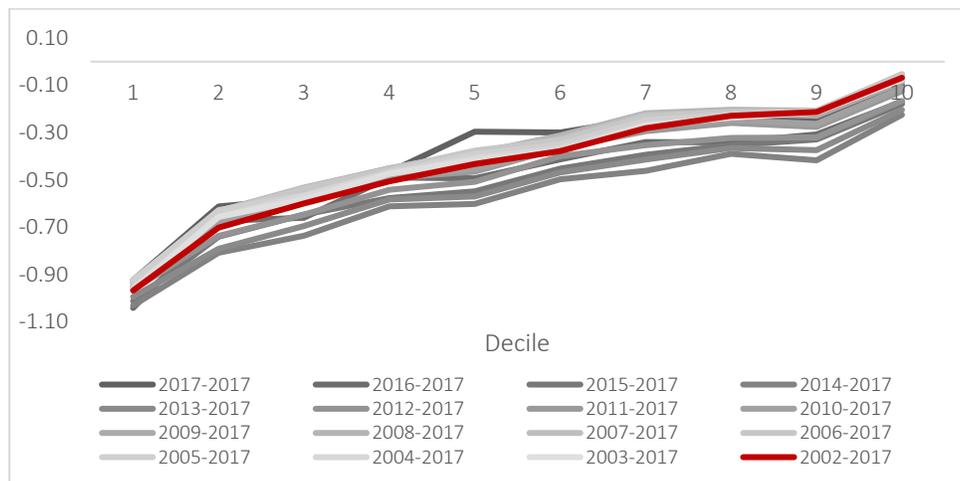
The empirical analysis of equation (2) assumes a log-log relationship among smoking intensity, price, and income. $\ln Q_{id}$ is observed if and only if the individual in a given decile d is a current smoker.

β_d is the coefficient of interest for each decile d . It is the (own) price-elasticity of demand for cigarettes, expressing the average percentage change in the quantity of cigarettes purchased by households in d , associated with a one percent change in the price of cigarettes.

Data restrictions force to use unitary values to proxy prices of cigarettes.

Elasticity simulations

Figure A5.1. Estimated price-elasticity of filtered cigarettes in Georgia, medium-bound, various periods

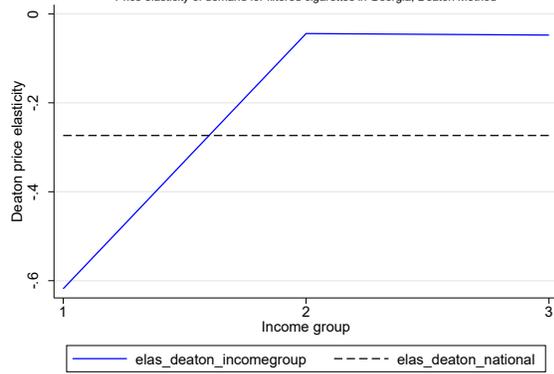


Source: Estimated based on the IHS, HIES, and ECAPOV harmonized consumption aggregates by the World Bank, various years.

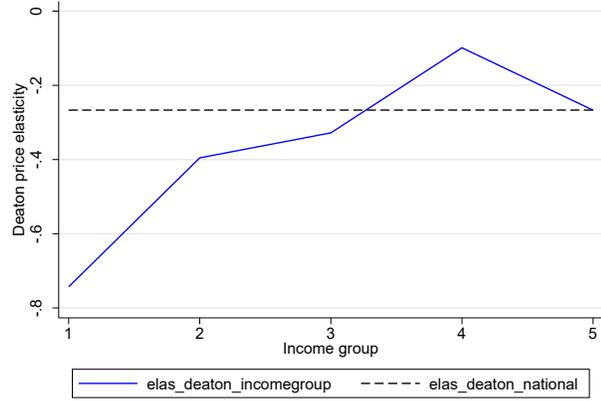
Annex 6. Application of the Deaton Methodology to calculate price elasticities of demand

Figure A6.1. Estimation of price-elasticity of filtered cigarettes by income group, applying the Deaton Method

Panel A. Terciles



Panel B. Quintiles

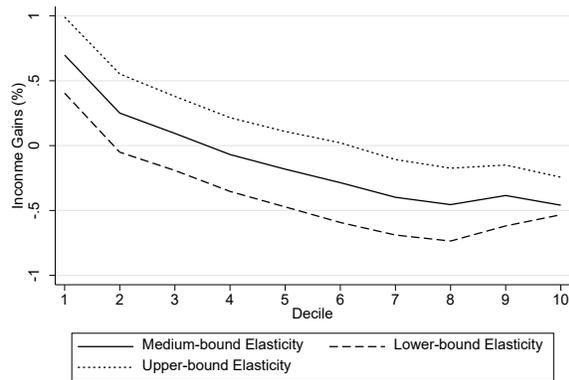


Source: Authors' estimation based on data from the IHS (2002-2016) and HIES (2017). Notes: Income groups are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. The Deaton method was adapted by the authors, based on previous applications by Deaton (2018) and Chelwa et al. (2019). Clusters are aggregated at the year, region, and urban-rural level. 1,000 bootstraps are applied.

Annex 7. Additional simulations of the net effect of increasing prices on cigarettes

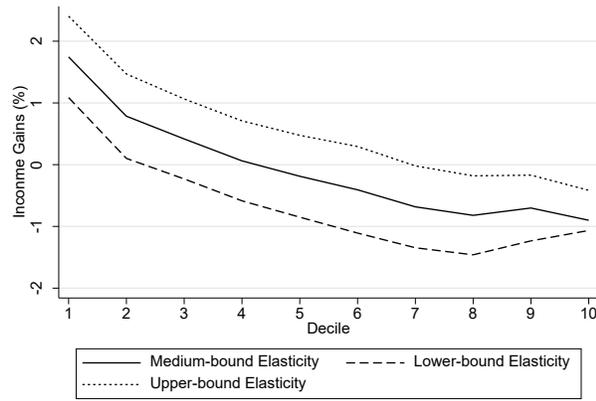
Figure A7.1. Net effects using *total* smoking-related Medical Expenses

Panel A. Homogenous 25% price increase



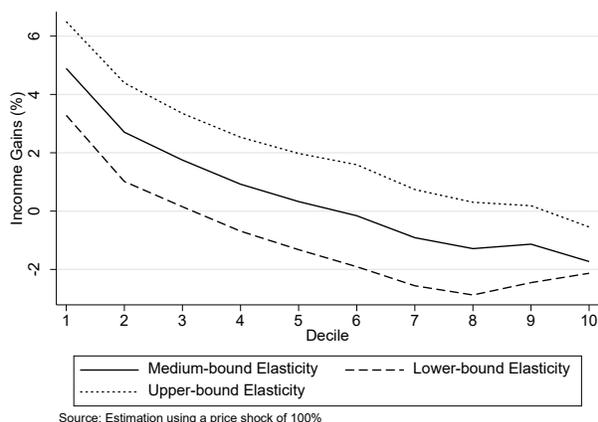
Source: Estimation using a price shock of 25%

Panel B. Homogenous 50% price increase



Source: Estimation using a price shock of 50%

Panel C. Homogenous 100% price increase



Panel D. Heterogenous price increase (47%)*

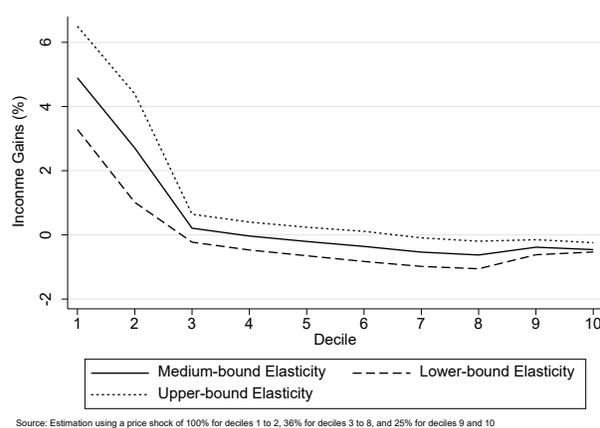
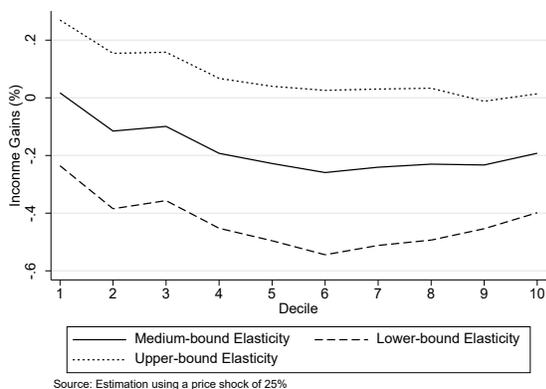
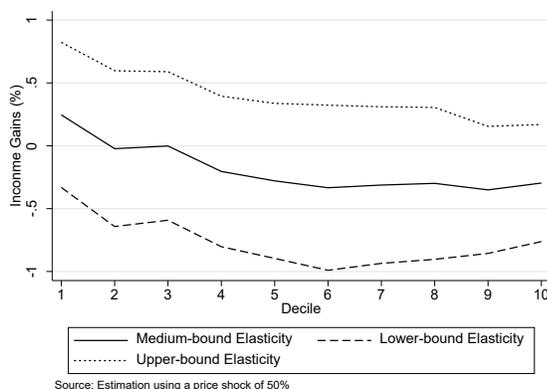


Figure A7.2. Net effects using *out-of-pocket* smoking-related Medical Expenses and estimated price elasticities of demand in Ukraine

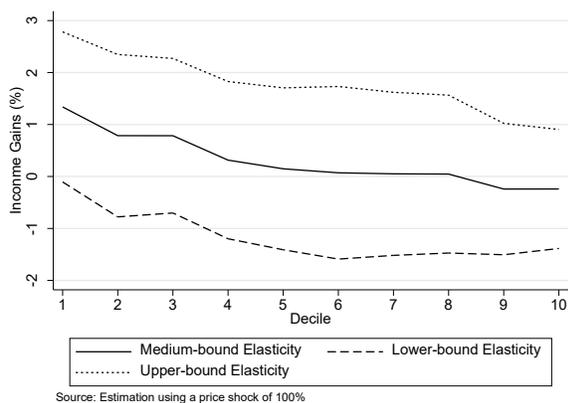
Panel A. Homogenous 25% price increase



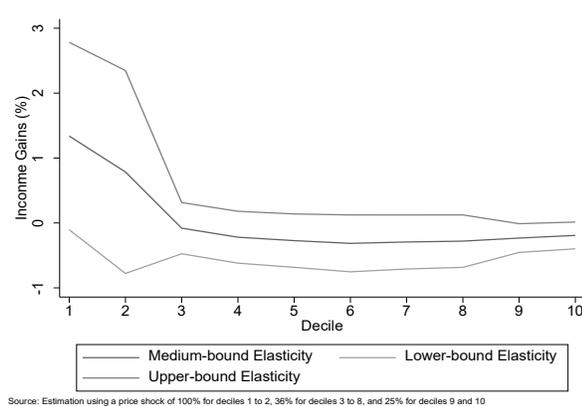
Panel B. Homogenous 50% price increase



Panel C. Homogenous 100% price increase



Panel D. Heterogenous price increase (47%)*



Source: Author estimations, based on the IHS (2012-2016) and HIES (2017). Data on smoking-attributable death events is taken from the GBD (2017), and tobacco-related medical expenses adapted from Goodchild et al. (2018) and WDI. Estimated price elasticities in Ukraine are taken from Fuchs and Meneses (2017a). Notes: Income groups are created based on household per capita consumption, based on the ECAPOV harmonized aggregate by the World Bank. * The heterogenous price shock corresponds to a price increase of: 100% for deciles 1 to 2, 36% for deciles 3 to 8, and 25% for deciles 9 and 10 (47% average).