Distributional Impacts of Tobacco Excise Taxes in Serbia

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Abstract

Background

The World Health Organization (WHO) estimates more than eight million people worldwide die from tobacco use every year. Currently, most of the world's tobacco users live in low- and middle-income countries. High smoking prevalence in those countries causes smoking-related diseases, consequently contributing to many premature deaths. Estimates show that in Serbia, with almost 2.2 million smokers (38 percent of the adult population), there were more than 15,000 deaths due to smoking in 2016 (Kilibarda, 2021). This study is the first to empirically assess the progressivity of tobacco taxes across three income groups in Serbia.

Methodology

We explore how tax increases lead to changes in tobacco consumption, smoking-related medical costs, lost productivity from premature deaths, and household budgets. Net household budget income effects were calculated as the sum of the following: the change in tobacco expenditure (accounting for price elasticities by income groups: low-, middle-, and high-income), the change in medical expenses (using the relative risk of morbidity/mortality from smoking and smoking-attributable fraction for smoking-related diseases), and the change in years of productive life (considering the years of working life lost among the working population).

Results

We employ a simulation of tobacco price increases of 5.1 percent and 22.4 percent (due to increases in the specific excise tax of 10 percent and 43.6 percent, respectively). In both scenarios, a total price increase would lead to decreased tobacco expenditures for the low-income group. The excise tax increase would lead to the reduction of medical expenses and an increase in productivity in all three income groups, especially in the low-income group. The total net gains in the disposable household budget in the case of

a 22.4 percent price increase would be 2.9 percent for the low-income group, 1.3 percent for the middle-income group, and 0.01 percent for the high-income group.

Conclusions

The specific tobacco excise tax in Serbia should be raised by at least 43.6 percent to effectively reduce tobacco consumption and, consequently, smoking-related medical costs and the related loss of productivity. The results of this study show the tax increase would have a progressive effect on the overall distribution of income since the poorest population is likely to benefit the most from this tax policy.

Introduction

According to WHO estimates, more than eight million people die each year from tobacco use (WHO, 2021).[1] Approximately seven million people die because of their own tobacco product consumption, and an additional 1.2 million die due to secondhand smoke exposure in public places, restaurants and bars, nightclubs, at work, or at home. It is expected that tobacco use will be the most significant cause of premature mortality and disability in the world by 2030. The Centers for Disease Control and Prevention in the United States of America (CDC) estimates that 20-40 percent of premature deaths are preventable through lifestyle modification such as smoking cessation or consumption of healthier foods.[2]

The use of tobacco and exposure to environmental tobacco smoke implies exposure of the human organism to numerous harmful substances. Harmful chemical compounds are found in every stage of the development of tobacco products—from the beginning of plant cultivation to the manufacturing of the final tobacco product. Cigarette tobacco smoke contains over 7,000 different chemical compounds, over 250 of which are dangerous to health. One-third of these compounds originate from tobacco plants, while the rest represent combinations of additives. Among those compounds with harmful effects on health, almost 70 cause cancer (Wild et al, 2020).

Because cigarette smoking has many harmful effects on health, it imposes a risk for many chronic noncommunicable diseases. The risk increases with the duration of smoking status and the number of cigarettes consumed. Smokers today have a higher risk of lung cancer than smokers 50 years ago, which can be explained by changes in cigarette design and composition. The leading cause of death, lung cancer, would be less common worldwide if smoking prevalence were very low (USDHHS, 2014).

Most tobacco users worldwide live in low- and middle-income countries. High smoking prevalence in those countries will result in many smokers facing smoking-related

[1] WHO. (2021). *WHO report on the global tobacco epidemic 2021: Addressing new and emerging products*.
[2] America's Health Rankings analysis of CDC WONDER, Multiple cause of death files, United Health Foundation

diseases and will, consequently, contribute to many premature deaths. At the same time, smokers with lower personal or family income are more likely to suffer from tobacco-related diseases than smokers with higher personal or family income. This is especially true since, as a result of tobacco use, smoking households spend less on food, clothing, education, and health care.[3]

Serbia is located in Southeastern Europe and considered an upper-middle-income country, according to the World Bank.[4] Consumption of tobacco products is widespread, especially for manufactured cigarettes and hand-rolled cigarettes. Smoking prevalence has declined over time but is still very high at nearly 38 percent among adults overall, with men smoking slightly more than women (Zubovic et al., 2020).

In addition to the almost 2.2 million people in Serbia who are smokers themselves, secondhand smoke exposure (SHS) is also extensive. One of the three most important places of SHS exposure for many adults in Serbia is workplaces, followed by homes and then restaurants and bars. In Serbia, smoking is prohibited in all public enclosed areas, including health care, education, and cinemas. However, the latest data show that 48.1 percent of adults are exposed to tobacco smoke at home (Zubovic et al., 2020).

In Serbia, more people with lower education are exposed to tobacco smoke at home compared to those with higher education, which aligns with results published by the CDC for people with low socioeconomic status in the USA.[5] It is concerning that more than 80 percent of households in Serbia with children up to 14 years of age allow smoking inside the house. If these negative trends continue, there may be an increase in tobacco-related illnesses among young people due to intensive exposure to tobacco smoke at home. Also, the latest survey results for Serbia indicate that more than 90

[3] Vladisavljevic, M., Zubovic, J., Đukić, M., & Jovanović, O. (2021). *Crowding out effects on tobacco consumption in Serbia.* Belgrade: Institute of Economic Science. http://tobaccotaxation.org/cms_upload/pages/files/256_topic_1_crowding_out_effect_-_reseach_report_-_final.pdf

[4] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[5] https://www.cdc.gov/tobacco/disparities/low-ses/index.htm

percent of people are exposed to tobacco smoke in restaurants, nightclubs, and bars, making them the most critical places for SHS exposure (Zubovic et al., 2020).

Considering the large number of daily smokers and those exposed to tobacco smoke, the population in Serbia is vulnerable to the development of smoking-related diseases. An increase in the number of patients suffering from smoking-related diseases will increase medical expenditures to treat such diseases, as well as loss of productivity due to illness-related absence from work and premature death. WHO estimates that at least 1.2 million current smokers will die prematurely in Serbia if stronger and stricter tobacco control measures are not implemented (WHO, 2016).[6]

Another estimation shows that more than 15,000 premature deaths due to smoking were registered in Serbia in 2016. The largest number of deaths was due to lung cancer and malignant diseases of the trachea (Kilibarda, 2021). There are no officially published data to estimate the economic cost of smoking in Serbia. However, the Tobacco Control Investment Case for Serbia is being prepared by the WHO Framework Convention on Tobacco Control (FCTC), WHO, United Nations Development Programme (UNDP), RTI International, and the Ministry of Health in Serbia, but no official results have been published to date.

Increasing taxes on tobacco complies with FCTC Article 6, which Serbia ratified in 2006.. Tobacco taxes in Serbia are currently below the level set under the Association Agreement and the European Union (EU) Directive 2011/64/EU, in which Serbia has committed to implementing excise duties on cigarettes of: (a) 60 percent of the average weighted retail price and (b) not less than EUR 90 per 1,000 cigarettes.

This research aims to analyze the impact raising tobacco taxes could have in avoiding the social and health costs of tobacco consumption. We use extended cost-benefit analysis (ECBA) methodology, described in more detail in Section 4 (Data and Methodology), to estimate the distributive effects of lower tobacco consumption arising from higher prices, decomposed into three components: changes in the disposable

[6] WHO. (2016). *Tobacco control fact sheet – Serbia*. https://www.euro.who.int/__data/assets/pdf_file/0008/312596/Tobacco-control-fact-sheet-Serbia.pdf

household budget, reduction in tobacco-related medical expenditures, and extension of working life years.

Literature Review

Many studies worldwide have aimed to assess the net impact of raising tobacco taxes on the welfare of households. Welfare issues in tobacco economics are experiencing increasing attention from the research community and policy makers since they relate to concerns about potential tobacco tax regressivity. To address these concerns, researchers assess the hypothesis that tax increases have a disproportionate impact on the poor. Most of the rigorous research follows the conceptual framework of the extended cost-benefit analysis (ECBA) (Pichon-Riviere, 2014), which relies on the aggregation of costs and benefits to assess medium- and long-term effects of projected tobacco tax increases. ECBA analyses typically account for three effects: household budget, medical expenses, and prevention of tobacco-related deaths among the working population.

Tax increases will—for smokers who continue to purchase the same amount of tobacco—induce a negative household budget shock. This is because higher cigarette prices increase the share of tobacco expenditures in household budgets, especially among smokers with lower income. This would be true if consumers' behavior were unaffected by the price increase. However, smokers usually adjust their behavior and reduce consumption after price increases, depending on their price elasticity. The level of elasticity affects the change in volume of disposable income. To estimate the net effect of increasing taxes on tobacco resulting in increased prices, we must compare gains against losses. Research results show that across countries, the net effects are positive at the aggregate level. However, at the individual household level the effects are negative for smoking households due to the fact that their price elasticity is below one, in absolute terms.

Most studies have confirmed positive effects of tobacco tax increases on household welfare, with results varying in terms of the size and the sources of beneficial

impact for specific income groups. Comparing distributional effects of projected tobacco tax increases in eight low- and middle-income countries, Fuchs et al. (2019) confirmed the negative direct effects of tax increases on household budgets. However, the negative effects of price shocks, especially among poor households, have been offset by significant long-term gains from lower medical expenditures and additional years of productive work.

Applying a cost-benefit analysis in the Russian Federation, Fuchs et al. (2018) found a long-term progressive impact of rising taxes that significantly depends on the conditional price elasticity being different across different population subgroups. The most price-responsive subgroups, including the poor and youth, would experience greater gains from the health and extended work years benefits. Assuming a 25-percent price shock and a complete pass-through, results show that, for a medium elasticity of -0.68, the bottom wealth decile would experience a welfare loss due to an increase in tobacco expenditures of 0.01 percentage points of their household expenditures. However, this welfare loss would be largely offset by the reduction of medical expenditures, estimated at 1.6 percentage points of household spending for the bottom decile. Moreover, an extension of working life years would result in saving an additional 0.49 percentage points of the bottom decile consumption.

Similarly, Macias et al. (2020) calculated net tobacco tax increase effects concerning two potential tax policy scenarios in the case of Mexico. Under the first scenario—assuming a moderate elasticity span between -0.59 (low-income group) to -0.47 (high-income group) and an increase in tobacco prices of eight percent, which reflects the existing policy of inflation-based tax updates - cigarette consumption would remain relatively stable. Under the second scenario, assuming a 58-percent price increase to reach the WHO-recommended 75-percent tax share in the retail price, the lowest-income households under the higher elasticity bound assumption would see progressive effects.

Given the comparatively lower elasticities, progressive effects are missing for the other two income groups (middle- and high-income). The overall welfare effects—including gains from lower medical expenses and increased productivity—would be

positive for all income groups, ranging from more than one percent of household consumption for high-income households to more than four percent for low-income households. Similar results have been found in related studies conducted in China (Veguet et al., 2015), Ukraine (Fuchs & Meneses, 2017), Moldova (Fuchs & Meneses, 2018), Vietnam (Fuchs et al., 2019), Peru (Rios et al., 2020), Argentina (Cruces et al., 2020), and Brazil (Divino et al., 2021).

Until recently, there was a notable lack of such research conducted in the Western Balkan region. However, cost-benefit analyses of tobacco tax increases have been conducted by Fuchs et al. (2019) for Bosnia and Herzegovina, followed by more recent ones by Mugoša et al. (2022) for Montenegro which confirms a progressive effect on the distribution of income, with an increase in disposable income of the low-income group between 1.6 and 1.8 percent, and for high-income group by 0.2 percent. Both show that the aggregate effects of a tax increase are positive and progressive for all income groups.

Fuchs confirmed that a tobacco price increase of 25 percent, under a medium elasticity assumption, would improve the welfare of households in the lowest and the second-lowest income deciles by 0.13 and 0.04 percent, respectively. The higher-income group would record a welfare loss. The overall effect of the price increase would be progressive, since even in the case of the complete pass-through scenario (increase in prices is completely transferred to consumers without a reduction in consumption) the negative effects would be smaller for low-income households.

Effects on medical expenses are strongly positive across all income groups and under all price elasticity scenarios. Depending on the income group, potential income gains range from 0.51–0.05 percent under the lower-bound elasticity to 0.47–0.03 under the higher-bound elasticity. Finally, although having a relatively negligible effect compared to medical expenses, income gains resulting from avoided productivity losses would additionally contribute to the welfare improvement of all income groups.

Overall, the existing research finds tobacco tax increases to be a progressive tobacco control policy, providing significant welfare benefits for low- and middle-income households while having a small negative effect on high-income households. Previous studies underlined important factors for success that need to be considered when

designing effective tax policies. First, as the behavioral response of low-income households is particularly important, it is of utmost importance to reduce the possibility of downward substitution and/or switching to illicit products, as it could diminish not only projected fiscal gains but also expected medical savings and productivity gains. Additionally, these studies suggest that cost-benefit calculations strongly depend on the estimated elasticity boundaries. Therefore, to achieve desired higher price-elasticity response, tax instruments should be further supported with non-price measures.

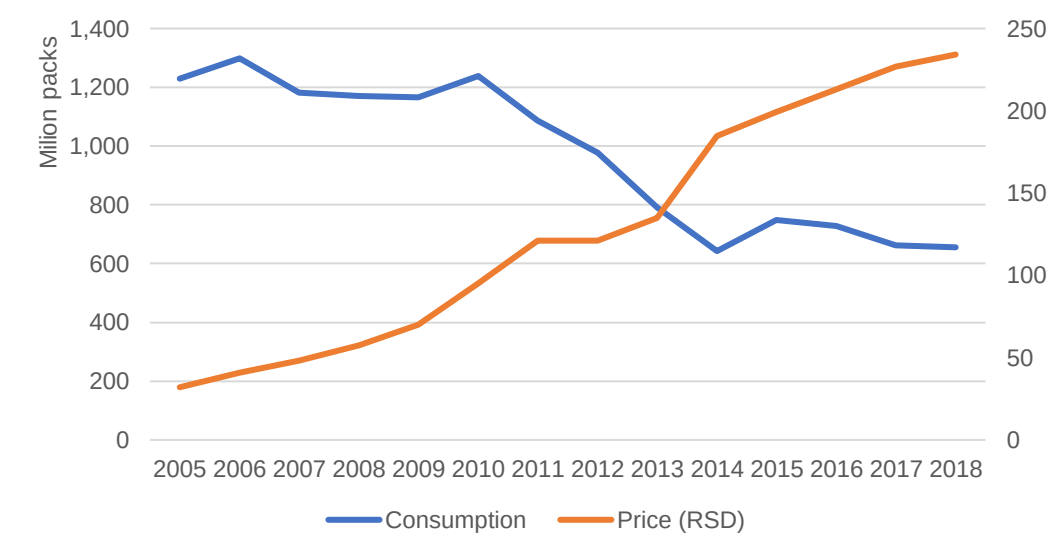
Data and Methodology

Both specific and ad valorem taxes are presently applied to tobacco products in Serbia. A so-called "excise calendar" is adopted to define the specific excise semi-annual growth followed by an increase in prices by RSD 10 (EUR 0.08). However, this growth in certain years (such as 2015)[7] is not sufficient to achieve a positive impact on tobacco consumption since it does not keep pace with income growth, resulting in increased affordability of tobacco products.

At the end of 2020, the total excise on the weighted average price for manufactured cigarettes was 58.7 percent. There has been a continuous annual decrease in excise share since 2017, when it reached its maximum of 61.0 percent. At the same time, in absolute figures, excises have grown from EUR 1.21 per pack to EUR 1.46 per pack (EUR 73 per 1,000 cigarettes). Meanwhile, consumption volume and prevalence rates have been decreasing continuously since 2005 (Figure 1), and at least part of this effect has been due to the increase in cigarette taxes and consequently cigarette prices.[8] Despite the effectiveness of these tobacco control policies, the socioeconomic costs of smoking are still very high in Serbia.

[7] Djukić, M., Zdravković, A., Zubović, J., Jovanović, O., & Vladisavljević, A. (2021). *Affordability of cigarettes in Southeastern European countries* (Tobacconomics Working Paper No.21/10/1).
[8] Vladisavljevic, M., Zubović, J., Đukić, M., & Jovanović, O. (2020). Tobacco price elasticity in Serbia: Evidence from a middle-income country with high prevalence and low tobacco prices. *Tobacco Control*, *29*(Suppl 5), s331-s336.

Figure 1. Consumption of cigarettes and retail price in Serbia



Source: Zubović et al. (2020)

Tobacco taxes encourage current smokers to quit and discourage potential consumers from initiating by increasing prices and reducing the affordability of tobacco products. At the same time, excise taxes on tobacco represent a significant component of fiscal revenue in Serbia, reaching RSD 108.6 billion (EUR 915 million) in 2020, which equals 4.8 percent of total budget revenues.[9]

To estimate the net effects of increased tobacco taxes, we use an extended cost-benefit analysis (ECBA) model with the formula below.

Net income effects = Change in tobacco expenditure (A) + Change in medical expenses (B) + Change in years of productive life (C) + Change in pensions (C+) (1),

where:

(A) = increase in tobacco expenditures after the tax increase at household level,

(B) = decrease of direct medical expenses needed for tobacco-related medical treatments, and

[9] https://www.mfin.gov.rs/dokumenti2/makroekonomski-i-fiskalni-podaci

(C) = additional income households can earn by increasing their productive life years.

(C+) = additional pensions household can receive by increasing years of life.

The net effects are calculated at the household level. The difference from the calculation at the aggregate national level is in medical expenses (B), which include both direct government costs of health along with the out-of-pocket costs used in the household calculations. Estimation of the effects is calculated using two scenarios: a) a 10-percent increase in the specific excise tax and b) a 43.6-percent increase in the specific excise tax. An increase of 10 percent would enable Serbia to achieve one component of the EU Tobacco Tax Directive recommendation that excise taxes comprise a 60-percent share of the retail price. An increase in the specific excise tax by 43.6 percent would enable reaching the second EU directive recommendation of EUR 90 in excise taxes per 1,000 cigarettes.

Changes in tobacco expenditures

Data used for estimation of changes in tobacco expenditures are:

- price elasticities of quantity demanded by income group (tercile),
- quantity and spending on cigarettes by household/individual and total income (spending), and
- tobacco tax structure (decomposed retail price).

Changes in tobacco expenditures are calculated using the formula

$$\frac{E_{C_0}}{E_{T_0}}\Big((1+\%\Delta p)\big(1+\varepsilon_p\%\Delta p\big)-1\Big) \qquad (2),$$

where:

E_{C_0} = spending on cigarettes (tobacco),

E_{T_0} = total income,

Δp = change in price, and

ε_p = tobacco price elasticity.

To estimate the change in retail price of cigarettes resulting from two different scenarios of 10-percent and 43.6-percent change in specific excise tax we use the formula

$$p_{cig} = p_{not} + \tau_{esp} + p_{cig} * \tau_{eav} + p_{cig} * \tau_{vat} \quad (3),$$

where:

p_{cig} = price of cigarettes,

p_{not} = price net of tax,

t_{esp} = specific excise,

t_{eav} = ad valorem excise, and

t_{vat} = value-added tax.

Hence the new retail price is

$$p^*_{cig} = \frac{t}{1-\tau_{eav}-\tau_{vat}} * \tau_{esp} + p_{cig} \quad (4).$$

For this study, we assume full pass-through from tax increase to price increase—that is, the entire increase in tobacco tax will be transmitted to an increase in prices (p_{not} remains constant). The current value-added tax (VAT) rate in Serbia is 20 percent. The ad valorem rate is 33 percent, and the average specific tax in 2019 was RSD 70.75 per pack. There is no tiered tax structure. The initial estimation is made using the weighted average price (WARP), which is published once a year by the Tobacco Administration Office. According to official data, WARP in 2019 was RSD 274.24 per pack.

Table 1. Change in the structure of cigarette price in Serbia with 10% and 43.6% increase of specific excise tax, 2019

		p_{cig}	p_{not}	t_{esp}	t_{eav}	t_{vat}	tax share	excise share
	initial	274.24	67.28	70.75	90.50	45.71	75.47%	58.80%
Scenario 1	10% increase	288.30	67.28	77.83	95.14	48.08	76.66%	59.99%
	Δ 1	5.13%		10%				
Scenario 2	43.6% increase	335.53	67.28	101.60	110.72	55.92	79.95%	63.28%
	Δ 2	22.35%		43.6%				

Source: Tobacco administration office in Serbia, authors' calculations

Therefore, when using WARP, the change in price is **5.1 percent** resulting from a 10-percent increase in the specific excise tax**.** In Scenario 2, we increase the specific excise by 43.6 percent resulting in an increase in price of **22.4 percent.**

To estimate the average change in tobacco expenditure by household, price elasticities by income group are applied to two different price changes. Using prevalence rates by income groups from the Household Budget Survey (HBS), we calculate the total number of smokers by income group. According to Zubović & Vladisavljević (2019), price elasticities for tobacco products in Serbia differ among income groups. Income groups are constructed based on total household expenditures (a proxy for income) per capita. Given the relatively small sample size, three income groups are created: low-income, middle-income, and high-income. After dividing the sample into three income groups, prevalence elasticity is estimated using a logit model and conditional demand (intensity) elasticity using the Deaton model. Total elasticity can be calculated according to the following formula

$$\xi p_{ig} = \xi p_{ig}1 + (1 + \xi p_{ig}1) * \xi p_{ig}2 \quad (5),$$

where:

$\xi p_{ig}1$ = prevalence elasticity;

$\xi p_{ig}2$ = conditional demand (intensity) elasticity;

ξp_{ig} = total elasticity, if all the elasticities are expressed as percentages; and

ig = income group.

Price elasticities in Serbia as calculated by Zubović & Vladisavljević (2019) are shown in Table 2.

Table 2. Tobacco price elasticity in Serbia by income group

ξp	Lower bound	Middle bound	Upper bound
Low income	-0.934	-1.076	-1.218
Middle income	-0.496	-0.631	-0.766

High income	-0.179	-0.220	-0.261

A limitation of the estimation is that it assesses only changes in spending on manufactured cigarettes. However, using the data from Table 3 (97.7 percent) and Table 4 (83.1 percent), manufactured cigarettes have a share of total consumption in Serbia of more than 81 percent (Tables 3 and 4).

Table 3. Percentage distribution of current tobacco users by type of product used, 2019

Manufactured and hand-rolled cigarettes, cigars, and cigarillos	Electronic cigarettes that produce a vapor from a liquid	Heated tobacco products
97.7	0.5	1.8

Source: Zubović et al. (2020)

Table 4. Percentage distribution of current users of "classic" combustible tobacco products, 2019

	Manufactured	Hand-rolled cigarettes	Cigars and cigarillos	Manufactured and hand-rolled	Manufactured and cigars, cigarillos
Overall	83.1	12.1	0.0	4.7	0.1

Source: Zubović et al. (2020)

Another limitation is related to tobacco sales in the illicit market, since no taxes are collected in such sales (Table 5). Some evidence suggests an increase in tax and price of legal cigarettes also pulls up the price of illicit cigarettes (Brown et al, 2017). So households that consume illicit tobacco may still pay more, even if not in taxes. Based on Zubović et al. (2019), the share of illicit cigarettes in Serbia is very low, therefore it does not significantly impact tax revenues. However, there may be some substitution from legal to illegal and from manufactured cigarettes to hand-rolled. A limitation of the current study is that, due to a lack of sufficient information, we are not able to take such market or product switching into account.

Table 5. Share of illicit manufactured cigarettes (MC) and hand-rolled (HR) tobacco consumption in Serbia, 2019

	Licit			Illicit			
	Average number of cigarettes smoked	Number of smokers	Total cigarette consumption	Average number of cigarettes smoked	Number of smokers	Total cigarette consumption	Illicit share
MC	17.3	2,224,728	38,452,392	15.9	59,387	943,244	2.4%
HR	11.9	51,769	616,593	15.6	386,949	6,034,238	90.7%
Total			39,068,986		446,335	6,977,482	15.2%

Source: Đukić et al. (2020)

Using the data from Tables 3, 4, and 5, we assume that consumption of manufactured cigarettes in Serbia is a good proxy to estimate the impact of changes in the specific excise tax rate on total spending on tobacco products. Since a very high share of hand-rolled tobacco is sold in the illicit market, we may reasonably expect there will be no or little change in expenditure on that portion of the market due to changes in excise rates. Finally, the share of electronic cigarettes and heated tobacco products is only 2.3 percent and therefore could not represent a significant impact on the total change in expenditure on tobacco products.

To calculate aggregate consumption at the national level, we use data from the Ministry of Finance on excise revenues for 2019. Total expenditure in the licit market in Serbia is estimated using the data in Table 5.

Table 6. Total licit expenditure on tobacco in Serbia, 2019 (billion RSD)

Total excise revenue 2019	Excise burden	Total expenditure
105.93	58.16%	182.14

Source: Authors' calculations using data from Ministry of Finance & Table 1

Total expenditure can be distributed by prevalence rates across different income groups (Table 6) among 2,194,640 daily smokers in Serbia.

Table 7. Current smoker prevalence rates by income groups, 2019

Income group	HR	MC	Total
Low	8.2%	36.0%	41.0%
Middle	5.8%	32.6%	36.9%
High	5.1%	30.4%	34.9%
Total	6.4%	33.1%	37.7%

Source: Zubović et al. (2020)

Applying the change in price by income group to the total expenditure will provide the aggregate change in tobacco expenditure (A) resulting from a 10-percent or 43.6-percent increase in the specific excise tax.

Change in tobacco-related direct medical expenses

The effect of reducing medical expenses after the tax-induced price increase in cigarettes yields positive income gains for all income groups, as the price shock encourages a reduction in smoking and, hence, a drop in tobacco-related medical expenses. Households can then benefit from higher disposable income, as they are no longer burdened by those medical bills. The volume of these benefits is especially large for the lower-income group of smokers.

Following the assumptions of the two different scenarios of increases in the specific excise tax, we estimate the change in tobacco-related direct medical expenses in two stages for all tobacco-attributable diseases (based on information on relative risk from the US Department of Health and Human Services (2014)), by gender, age group, and type of illness).

The first stage is a calculation of the smoking-attributable fraction (SAF) of medical expenses. The data required include:

- list of smoking-related ICD codes (details in Appendix Table A1);[10]
- public medical expenditure for treatment of smoking-related diseases from the Republic Fund of Health Insurance by age, gender, and ICD code in Serbia 2019 (Appendix Table A2);
- estimated out-of-pocket medical expenditures for treatment of smoking-related diseases; and
- relative risk (RR) of mortality/morbidity by ICD code from smoking and smoking prevalence to calculate SAF (smoking-attributable fraction).

Data are applied for each age, gender group, and disease type—both for current smokers and former smokers:

$$SAF_{ag} = \frac{Pe_{ca}*(RR_c-1)+ Pe_{fa}*(RR_f-1)}{Pe_{ca}*(RR_c-1)+ Pe_{fa}*(RR_f-1)+1} * 100\% \quad (6),$$

where:

SAF_{ag} = smoking-attributable fraction by age and gender,

Pe_{ca} = prevalence of current smokers in age group a,

Pe_{fa} = prevalence of former smokers in age group a,

RR_c = relative risk mortality/morbidity by disease for current smokers, and

RR_f = relative risk mortality/morbidity by disease for former smokers.

Calculation of the change in tobacco-related medical expenses follows:

- Define the list of smoking-related diseases by ICD-10 codes (details in Appendix Table A1).[11]
- Obtain data on medical expenses and calculate SAF and smoking-attributable spending for each income group.

[10] ICD-10 codes: C00-C14, C15, C16; C32; C25; C33–C34; C53; C64–C65; C67; I00–I09, I26–I51; I20–I25; I60–I69; I70–I78; J10–J18; J40-J42, J43, J44

[11] ICD-10 codes: C00-C14, C15, C16; C32; C25; C33–C34; C53; C64–C65; C67; I00–I09, I26–I51; I20–I25; I60–I69; I70–I78; J10–J18; J40-J42, J43, J44

- Calculate the change in medical expenditures by income group by:
  - using mortality RRs as the proxy for morbidity RR (USDHHS, 2014) (for details, see Appendix Table A2);
  - applying the formula for calculation of SAF (WHO, 2011, p.32) on the smoking prevalence rates for current and former smokers (SAF is the same for current and former smokers) and RRs for each smoking-attributable disease and by gender and age group (Appendix Table A4); and
  - applying SAF on data from Table 7.

Effect on income from reducing medical expenditures is calculated by

$$\Delta SAHE_i = \left(\varepsilon_p * \%\Delta p\right) * \frac{E_{MC_0}}{E_{T_0}} \quad (7),$$

where E_{MC_0} represents medical spending on treatment of tobacco-related diseases, *i* stands for income group, and the other values in the equation are the same as in equation (2).

Total health care expenditures in Serbia are estimated at USD 641 per capita in 2019 (World Bank, 2022), equaling a total of USD 4.45 billion, or 8.6 percent of GDP, in 2019.[12] Out-of-pocket payments are very high and account for 40.0 percent of health expenditures, or USD 256 per capita, equaling a total of USD 1.78 billion (World Bank, 2022).

A somewhat different distribution of cost is presented by WHO global health expenditure data.[13] While the total expenditure remains the same, the share of out-of-pocket costs is lower, accounting for 37 percent, with its total expenditure reaching USD 1.65 billion (RSD 174 billion).

Using HBS data from 2019, we can distribute these costs across income groups (Table 8).

[12] https://databank.worldbank.org/source/health-nutrition-and-population-statistics
[13] https://apps.who.int/nha/database/ViewData/Indicators/en

Table 8. Distribution of out-of-pocket medical expenses in Serbia by household income group, 2019

Income group	Select medical expenses* (RSD per HH monthly)	Select medical expenses as % of average medical expenses	Total income (RSD per HH monthly)**
	(1)	(2)	(3)
Low	1,980	83.4%	55,905
Middle	2,303	97.1%	65,749
High	2,837	119.5%	79,688
Average	2,373		67,104

* Medicines, hospital services, outpatient care and inpatient care

** Total number of households is 2,466,316. Average household size is 2.68 people.

Source: HBS in Serbia, 2019

The distribution shown in column (2) in Table 8 can be applied to allocate medical spending across the three income groups, the sum of which represents E_{MC_0}. However, since household budget surveys usually underreport costs, we use data from the Republic Fund for Social Protection (Appendix Table A2) for the smoking-related costs, according to which the average direct cost per household is RSD 10,388. As stated above, the out-of-pocket costs account for 40 percent, which per household equals RSD 6,925.

Therefore, we estimate medical expenses per household using the distribution from column (2) in Table 8, which is shown in Table 9.

Table 9. Distribution of out-of-pocket medical expenses in Serbia by household using RFSP data, 2019

Income group	Select medical expenses as % of average medical expenses	Select medical expenses* (RSD per HH monthly)
	(1)	(2)
Low	83.4%	5,775
Middle	97.1%	6,725
High	119.5%	8,275
Average		6,925

Source: The Republic Fund for Social Protection, Serbia

Additional income earned from increased years of productive life

In this section we estimate the value of additional income that could be earned by all household members resulting from an increase in the specific excise tax by 10 percent. Changes in the years of working life lost (YWLL) need to be estimated by income groups and five-year age cohorts (formula (8)). Data required for calculation include:

- smoking-attributable death events (SAF * total number of deaths from smoking-related diseases) and
- years of life lost among the working population.

Data on the number of deaths are extracted from the Institute for Public Health database (Republic Fund of Health Insurance, 2022). SAF is calculated using RR estimates as explained above. Additionally, RR rates from WHO databases (WHO, 2011) and available estimates for Eastern European countries will be used for robustness check (Stefler et al., 2018).

$$\text{Effect on income from reducing YWLL} = ((\varepsilon_p * \%\Delta p * \text{YWLL}_i) * \frac{HIi}{E_{T_0}}) \quad (8),$$

where:

ε_p = price elasticity per income group,

$\%\Delta p$ = percentage change in price,

YWLL_i = number of years of working life lost per smokers' household per income group, and

$\frac{HIi}{E_{T_0}}$ = share of the household income in the total household budget.

However, since in this study we use HBS data, total expenditure is a proxy for income, so this ratio would be equal to one. If actual information on income and spending per household were available, the ratio may be different.

To estimate the increase in working years by income group, the total tobacco-attributed years of life lost are distributed across income groups proportionately to the number of households that consume tobacco per income group.

Additional income earned is estimated using the following steps.

- Identify number of deaths among the working population by age group and ICD10 (Appendix Table A5).
- Estimate YWLL by age group using SAF from Appendix Table A4 (Appendix Table A6).
- Determine income by age cohorts using HBS data.
- Calculate effects on income using equation (8).

Additional income earned from increased years of productive life

Similar to the increase in income from increased years of productive life, we estimate the increase in pensions available due to increase of years of life to the age of 75.

Effect on income from decreasing years of pension life lost YPLL = (($\varepsilon_p * \%\Delta p$ * YPLL$_i$)* $\frac{HIi}{E_{T_0}}$)

(9),

where:

ε_p = price elasticity per income group,

$\%\Delta p$ = percentage change in price,

YPPL$_i$ = number of years of pension life lost per smokers' household per income group, and

$\frac{HIi}{E_{T_0}}$ = share of the household income in the total household budget.

Results

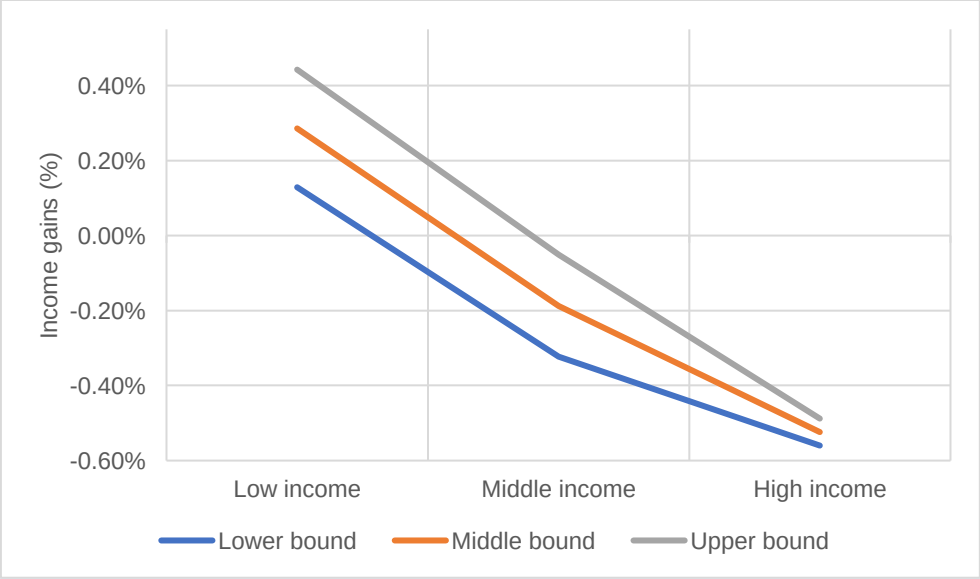
Change in tobacco expenditure

The impact of a tax increase on tobacco expenditures is assessed through an interaction of price increases, price elasticities for each income group, and household budget share spent on cigarettes. Income changes are determined for each income group based on the low-, middle-, and upper-bound elasticities. Using the assumptions from both scenarios in Table 1, price increases of 5.1 and 22.4 percent (as a result of specific excise tax increases by 10 percent and 43.6 percent, respectively) lead to positive effects for the low-income group, who would have the highest gains in available income in both scenarios (Figure 2). The high-income group, on the other hand, would experience a small loss under all assumptions.

Figure 2. Change in tobacco expenditures by income groups after tax increase

Scenario 1 – 10% increase in specific excise

Scenario 2 – 43.6% increase in specific excise



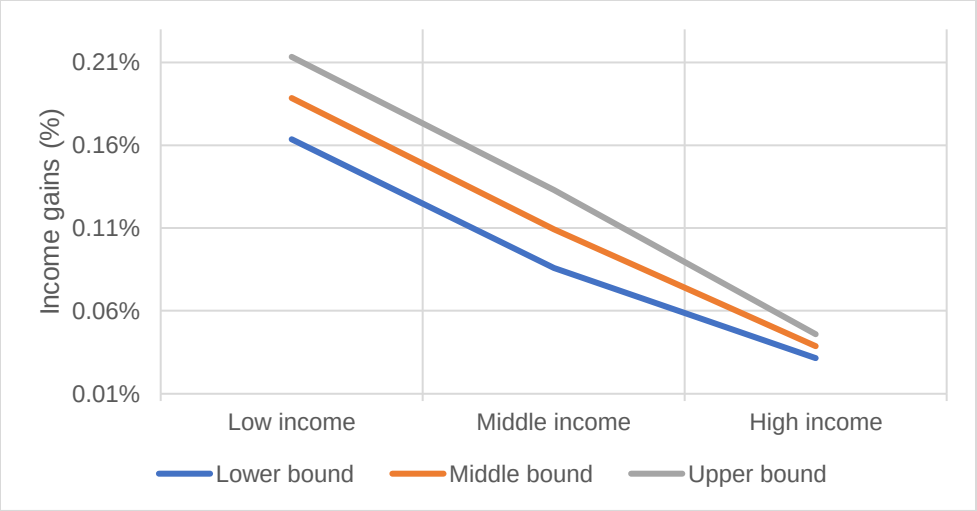
If cigarette prices rise by 5.1 percent, the expected increase in available income for the low-income group would be 0.03 percent, given the middle-bound elasticity. In the wealthiest group, the simulations show income losses of 0.13 percent (Figure 2, Scenario 1). The implementation of a higher cigarette tax would have a more progressive effect, meaning lower consumption, lower affordability, and more resources for other beneficial spending. The positive effects would be most pronounced among the poorest individuals, as their available disposable income would become higher after the price increase. This is especially the case in Scenario 2, with the higher increase in prices. For more details, see Appendix Table A7.

Change in health costs

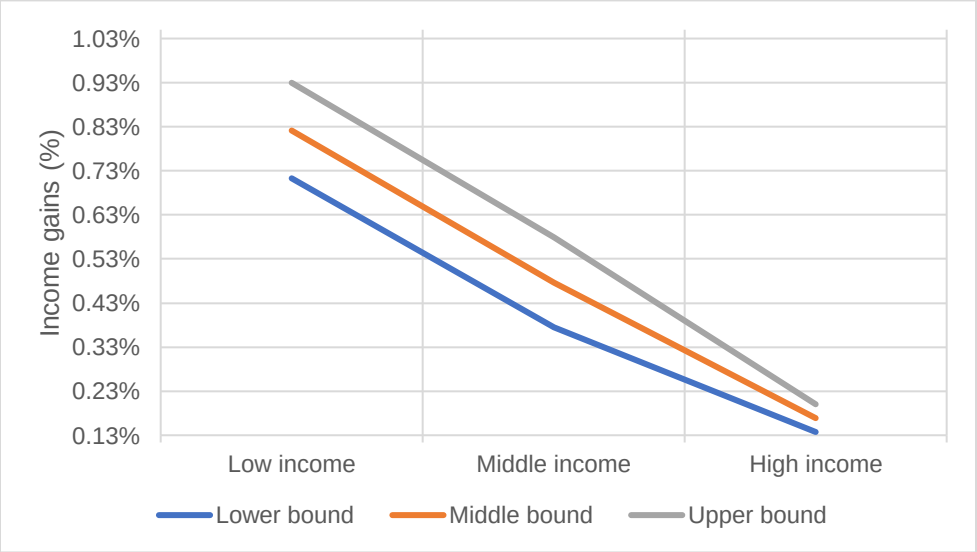
Increasing tobacco taxes could further boost the progressive effect on income through the resulting reduction of tobacco-related medical expenditures. Figure 3 shows the positive impact of reduced health expenses on income gains under both price increase scenarios.

Figure 3. Change in medical expenditures by income groups after tax increase

Scenario 1 – 10% increase in specific excise



Scenario 2 – 43.6% increase in specific excise



The scenarios presented in Figure 3 show the effects of two different price increases on medical expenditures reduction. Positive income gains are obtained in each scenario, and specifically in the low-income group, which confirms the progressive effect of tax increases regardless of the elasticity and SAF assumption. The higher benefits in the poorest group are derived from higher responsiveness to price changes and a lower income base, similar to the changes in tobacco expenditures in part A of the model.

The poorest population group will have more resources after the tax increase, as the reduced prevalence and quantity consumed would lower the incidence of smoking-related diseases and, subsequently, the spending to treat them.

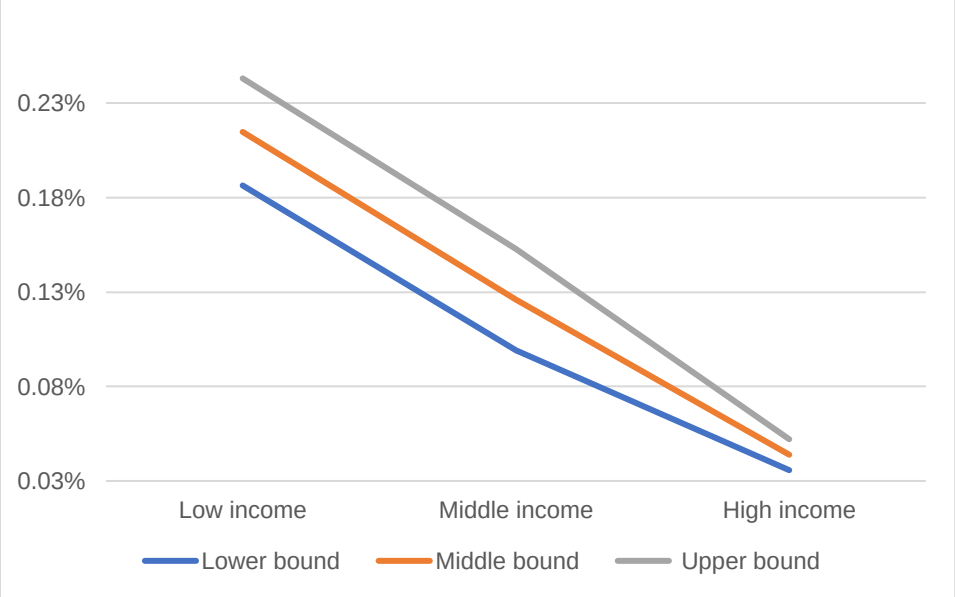
In the scenario of a 22.3-percent price increase, the simulated income gain in the poorest population would range from 0.24 to 0.32 percent. The positive income effects obtained through the tax increases are in line with those calculated in other studies using a similar approach. In the higher-income group, the effects are significantly lower. For more details see Appendix Table A8.

Change in productivity

The increase in tobacco taxes results in a decline in smoking prevalence. This not only reduces expenses for treating smoking-related diseases, but it also would decrease the number of smoking-attributable deaths. The positive effects are obtained through higher earnings associated with the lower number of years of working life lost (YWLL), or increased number of years at work.

Figure 4. Change in disposable income by income groups after tax increase

Scenario 1 – 10% increase in specific excise



Scenario 2 - 43.6% increase in specific excise

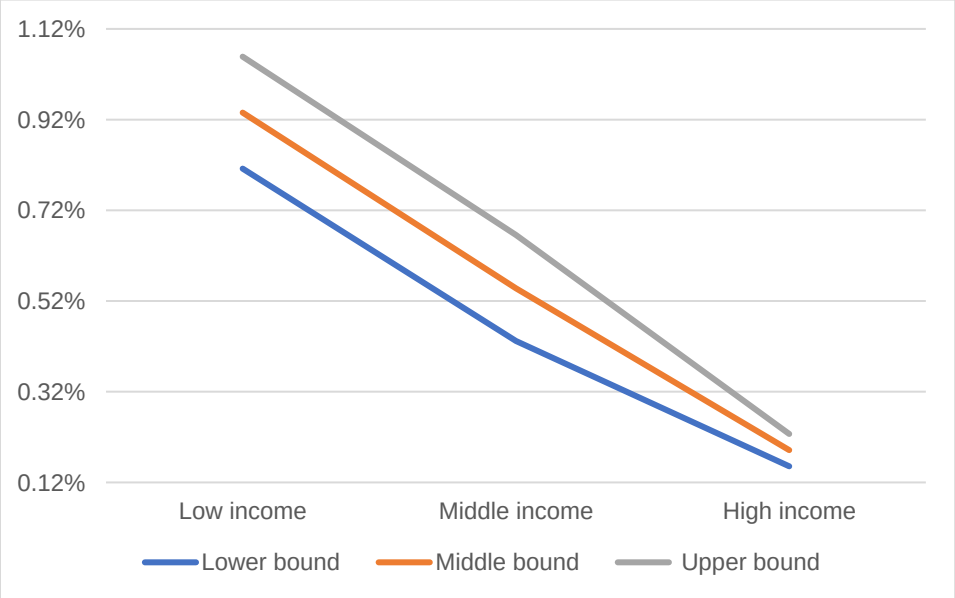


Figure 4 shows significant positive income gains for all income groups in both scenarios. The results confirm that all three income groups would gain additional income, due to the lower number of YWLL. The poorest group has nearly a one-percent increase in income, while the wealthiest group has a somewhat lower increase of 0.23 percent in the scenario with a 43.6-percent excise tax increase. For more details see Appendix Table A9.

In this study we introduce the assumption that change in household income also occurs for extended periods of time with pension income. Current average life expectancy in Serbia is 75 years, which is approximately ten years after the retirement age. In estimating the gains from years of retirement life lost, we reduce their effect to 42.3 percent, which is equal to the share of pensions in average wage.

Effect on income from reducing YWLL = $((\varepsilon_p * \%\Delta p$ * (YRLL+YWLL$_i$)* $\frac{HIi}{E_{T_0}})$ (9),

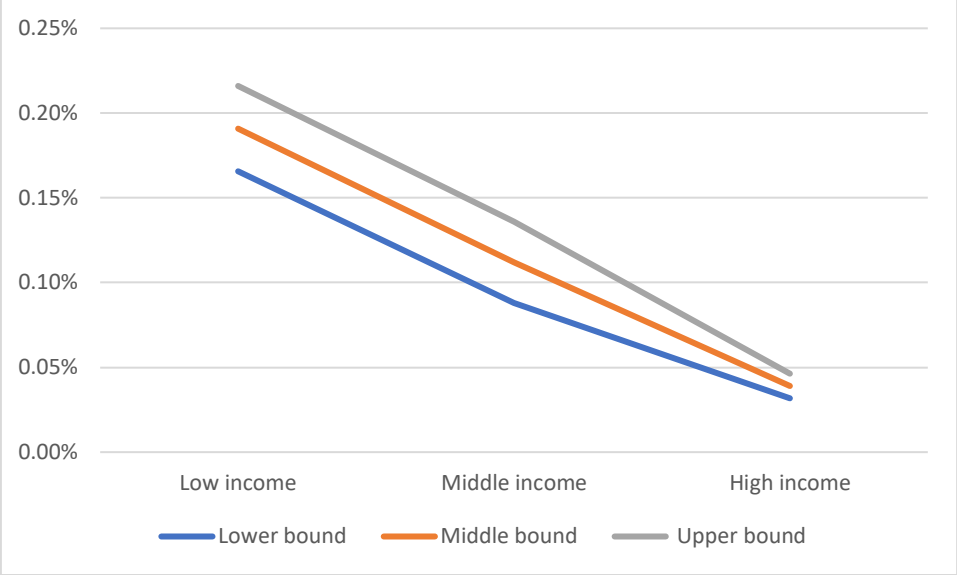
where:

YRLL = years of retirement life lost.

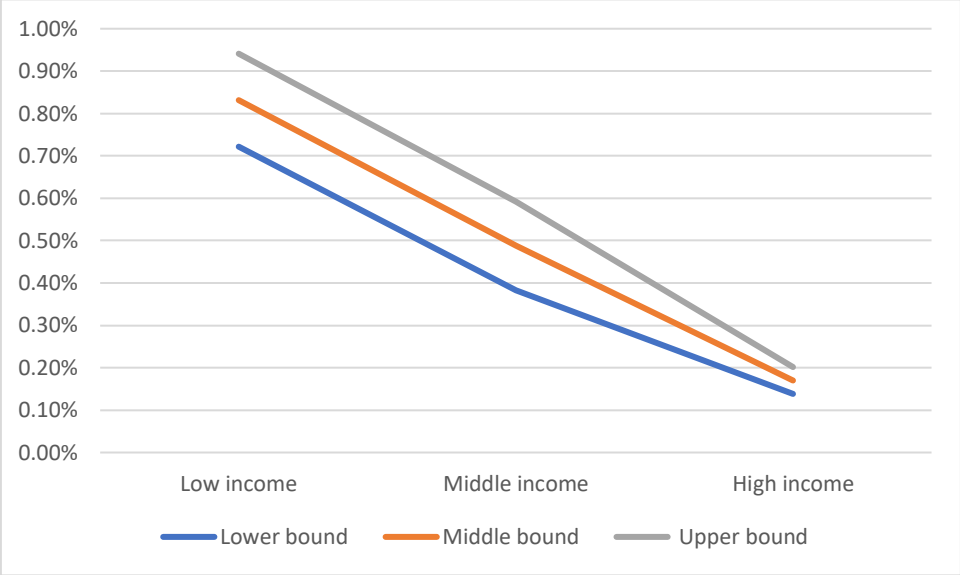
Change in pensions

Figure 5. Change in pensions income by income groups after tax increase

Scenario 1 – 10% increase in specific excise



Scenario 2 – 43.6% increase in specific excise



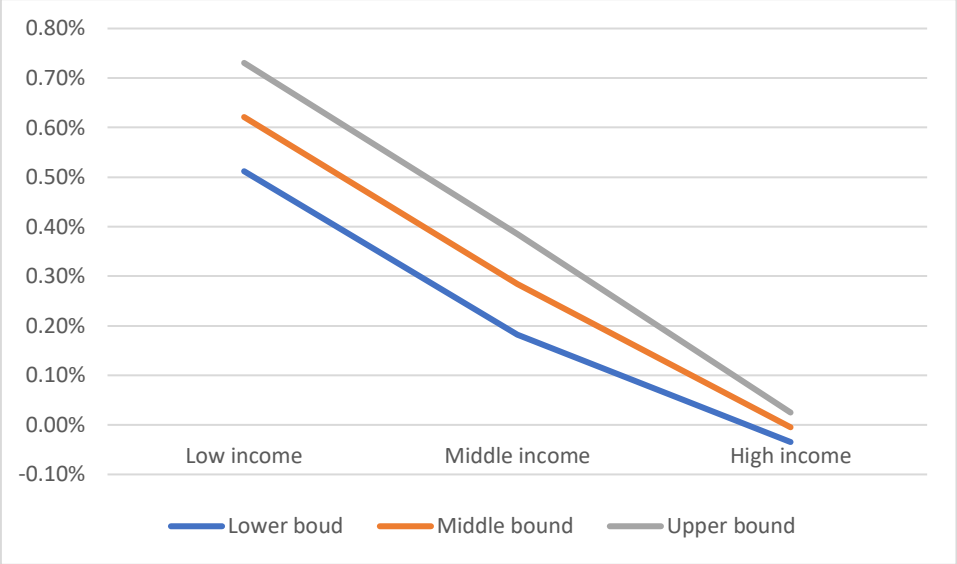
In Figure 5 we present the change in disposable household income resulting from longer periods of receiving pensions gained by reduced smoking prevalence. This increases the gains in disposable income per household for scenario 2 by 0-17 in high-income to 0.83 percent in low-income group, . For more details see Appendix Table A10.

Net gains

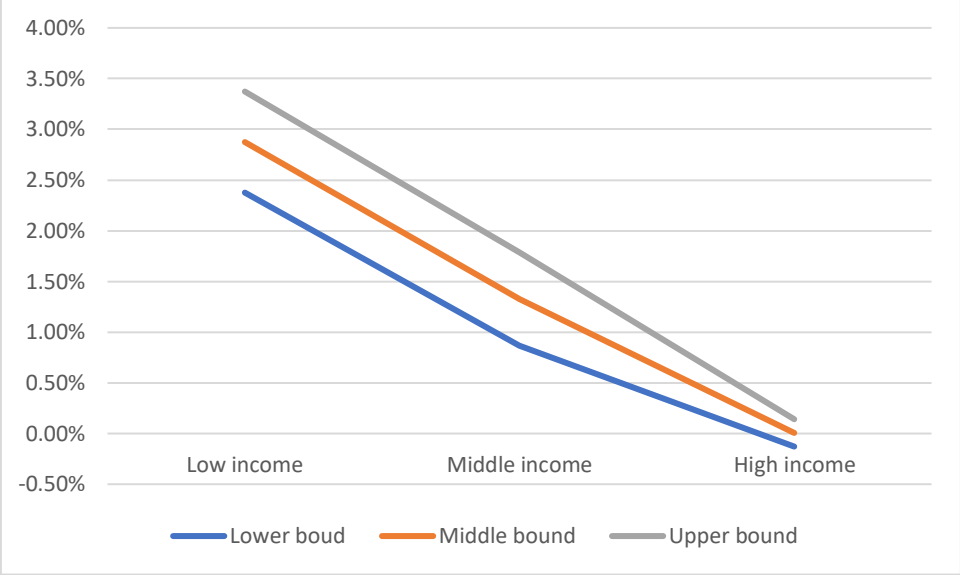
To estimate the net gains, we sum up the changes in consumption, medical costs, productivity, and pensions (Figure 6). Under all assumptions designed in the two scenarios the income gains are positive, outweighing the costs, and tax progressivity is confirmed.

Figure 6. Net gains

Scenario 1 – 10% increase in specific excise



Scenario 2 – 43.6% increase in specific excise



Confirming the progressivity of tobacco tax increases, the highest gains in disposable income are projected for the low-income group, especially in the case of the higher price increase. In the scenario of a 22.3-percent price increase resulting from a 43.6-percent specific excise tax increase, the simulated net income gain magnitude ranges from 1.65 to 2.43 percent in this group. For the high-income group, the effect is negative from -0.06 to -0.27 percent. After including change in pensions, the figures move slightly up to a range 2.38 to 3.37 for low income and -0.13 to 0.14 for high income group. For more details, see Appendix Table A11 and A12.

Discussion, Conclusions, and Recommendations

This study estimates the impacts of tobacco taxes in Serbia using an extended cost-benefit analysis. The main goal of this research is to determine the gains at the household level that could be obtained from the reduction in tobacco consumption as a result of increased excise taxes. The estimated income gains are positive for all income groups, with the highest increase in available income estimated for the low-income group.

Total licit annual tobacco expenditure for the 2.2 million smokers in Serbia equals RSD 182 billion (EUR 1.5 billion), which constitutes a substantial part of household budget expenses. In this study we use data from several comparable sources - disaggregated by income level, gender, and type of disease - in order to make the most accurate estimations. Two scenarios were analyzed: 10-percent and 43.6-percent specific excise tax increases, resulting in 5.13-percent and 22.35-percent price increases, respectively.

We estimated the net effects of increased tobacco taxes by adding the change in tobacco expenditure (A) to the change in medical expenses (B) and the change in income resulting from the change in years of productive life (C).

To estimate the changes in tobacco expenditure we used price elasticities by income groups from prior research. If the price of cigarettes rises by 5.1 percent (14 RSD), the expected increase in available income for the low-income group would be 0.03 percent, or 201 RSD annually, given the middle-bound elasticity. In the wealthiest group

the simulations show income losses of 0.13 percent. In the second scenario, with a higher tax increase, the results are 0.29 percent (1,945 RSD annually) and -0.52 percent for the low-income and high-income groups, respectively.

To estimate the changes in tobacco-related medical expenses we first calculated the smoking-attributable fraction (SAF) of total medical expenses using data on health expenditure by ICD codes from the RFZO. Distribution of expenditure by income groups was used from the household budget survey in 2019. Smoking status and prevalence rates by age cohort and gender were used from previous research based on the STC-SEE survey data. Using the RR from the USA we calculated the changes in medical expenditure. In the scenario of a 22.3-percent (61 RSD) price increase, the simulated income gain in the poorest population would range from 0.71 to 0.93 percent (4,763 to 6,239 RSD annually.

The change in disposable income resulting from the change in years of productive life was calculated by applying SAF rates to data on the number of deaths by ICD codes provided by SORS. These data were applied to different age groups. In the scenario with a 43.6-percent excise increase resulting in increased price by 61 RSD, the poorest group has a nearly one-percent increase in income (6,300 RSD annually), while the wealthiest group has a somewhat lower increase of 0.2 percent (1,817 RSD annually). When accounting for the change in pension revenues the increase in disposable income is 0.83 percent (5,568 RSD annually) for the low-income group and 0.17 percent for the high-income group (1,626 RSD annually).

Summing up the A, B, and C components in the scenario of a 22.3-percent price increase (61 RSD), the simulated net income gain magnitude ranges from 1.65 to 2.43 percent (11,069-16,300 RSD annually) in the low-income group. For the high-income group we end up with a negative effect in the range of -0.06 to -0.27 percent. If including the change in income due to incraesed pensions the results are even more positive, with a net change in income by 2.8 percent (19,320 RSD annually) for the low-income group, while for the high-income group it is around 0.01 percent (95.6 RSD annually).

Limitations of the study, while having no significant impact on our findings, include the following.

- All estimations are made only for manufactured cigarettes. However, their share in the Serbian tobacco market is 83.1 percent, which is high enough to make general conclusions.
- When increasing cigarette prices, some substitution may occur from legal to illegal and from manufactured cigarettes to hand-rolled, for which we were not able to control due to lack of data.
- Changes in prices of the licit market lead to changes in prices in the illicit market. However, there would be no impact on government tax revenues, since there are no tax revenues from the illicit market.

Recommendations

Raise the specific excise tax in Serbia by at least 43.6 percent, resulting in the increased retail price by 61 RSD, to reach the EU directive level of an overall excise rate of at least EUR 90 per 1,000 cigarettes to effectively reduce consumption and the high prevalence of tobacco use. Tobacco excise taxes show fundamental progressivity: a higher cigarette tax would have a progressive effect on the overall distribution of income because the poorest population would benefit the most from this tax policy, having an increase in the disposable net income by up to 19,320 RSD annually.

Promote public awareness programs on the health risks and costs of tobacco use. Revenues collected from excise taxes do not cover the externality costs of medical expenses and loss in productivity. Therefore, the public should be aware of the importance of reduced smoking prevalence and intensity that simultaneously increases revenues and decreases costs at the national level.

Ensure strong enforcement of tobacco tax collection to achieve the full benefits of the tax reform to the population. Strong enforcement to minimize illicit sales, especially of RYO tobacco, is critical to efficiently collect taxes and minimize tax avoidance and evasion. This will lead to reduction in tobacco use as well as its negative consequences on health and productivity.

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Appendix

Table A1. Causes of smoking-related death according to International Classification of Diseases (ICD-10)

Malignant Neoplasms	
Upper aerodigestive tract	C00-C14, C15, C32
Stomach	C16
Pancreas	C25
Trachea, bronchus	C33–C34
Cervix uteri	C53
Kidney, other urinary	C64–C65
Urinary bladder	C67
Acute myeloid leukemia	C92
Cardiovascular Diseases	
Other heart disease, all ages	I00–I09, I26–I51
Ischemic heart disease	I20–I25
Cerebrovascular diseases	I60–I69
Arterial disease	I70, I71, I72-I78
Respiratory Diseases	
Other respiratory diseases	J10–J18
Chronic obstructive pulmonary disease	J40-J42, J43, J44

Source: WHO (2011)

Table A2. Public medical expenditure for treatment of smoking-related diseases in Serbia, 2019 (RSD)

Gender	ICD-10 Code	Number of interventions	0-35	36-65	65+	Total
F	C00-C14	1,451	1,750,764	38,581,378	25,148,780	65,480,922
M	C00-C14	2,953	4,108,928	97,661,362	74,614,872	176,385,162
F	C15	255	6,186	8,962,080	8,897,599	17,865,865
M	C15	755	763,338	44,864,758	36,361,368	81,989,465
F	C25	1,318	1,380,339	61,493,143	91,628,937	154,502,420
M	C25	1,847	1,480,776	88,938,850	108,877,824	199,297,449
F	C32	800	13,717	20,175,951	17,357,128	37,546,796
M	C32	3,124	59,681	130,752,651	120,960,322	251,772,653
F	C33-C34	7,230	4,129,165	464,662,880	457,170,232	925,962,277
M	C33-C34	12,591	5,493,210	668,368,634	806,206,380	1,480,068,224
F	C53	7,251	15,781,789	218,431,052	67,852,729	302,065,570
M	C53	13	499	296,433	14,425	311,357
F	C64-C65	1,570	1,981,168	31,253,242	31,594,077	64,828,487
M	C64-C65	2,482	8,703,843	59,592,223	57,052,852	125,348,918
F	C67	3,688	431,802	56,375,030	90,392,395	147,199,226
M	C67	6,914	568,332	149,649,777	269,642,353	419,860,462
F	I20-I25	48,970	6,652,761	676,820,343	1,189,822,324	1,873,295,429
M	I20-I25	72,496	26,368,505	2,254,413,747	2,167,630,056	4,448,412,307
F	I00-I09; I26-I28; I29-I51	90,190	108,782,105	681,227,977	1,527,873,983	2,317,884,064
M	I00-I09; I26-I28; I29-I51	93,853	204,058,107	1,297,717,242	1,847,840,322	3,349,615,671
F	I60-I69	35,105	38,513,008	782,103,051	1,024,193,608	1,844,809,667
M	I60-I69	37,555	53,366,377	709,937,426	928,379,304	1,691,683,106
F	I70	5,221	419,766	48,131,396	91,509,610	140,060,772
M	I70	8,627	900,548	114,873,365	168,627,732	284,401,645
F	I71	1,649	1,152,232	54,211,750	133,626,818	188,990,799
M	I71	5,426	16,752,557	306,899,412	418,640,488	742,292,457
F	I72-I78	5,660	2,780,623	33,599,807	60,263,141	96,643,571
M	I72-I78	4,875	8,982,455	82,958,710	124,495,203	216,436,367
F	J10-J11; J12-J18	118,953	256,785,191	2,261,217,971	4,415,345,350	6,933,348,512
M	J10-J11; J12-J18	135,860	386,489,151	3,821,963,927	4,891,525,291	9,099,978,369
F	J40-J42; J43	6,284	2,857,039	10,913,366	10,538,317	24,308,722
M	J40-J42; J43	6,355	5,385,299	21,422,125	18,897,081	45,704,505
F	J44	18,404	2,099,507	123,909,246	168,155,661	294,164,413
M	J44	23,608	4,932,305	131,294,149	251,639,210	387,865,664
		773,333	**1,173,931,074**	**15,553,674,453**	**21,702,775,767**	**38,430,381,294**

Source: Republic Fund for Social Protection of Serbia (2022)

Table A3. Risk rates by ICD-10 codes

Disease category (ICD–10 code)	Men		Women	
	Current smoker	Former smoker	Current smoker	Former smoker
Malignant neoplasms				
Lip, oral cavity, pharynx (C00–C14)	10.89	3.40	5.08	2.29
Esophagus (C15)	6.76	4.46	7.75	2.79
Stomach (C16)*	1.96	1.47	1.36	1.32
Pancreas (C25)	2.31	1.15	2.25	1.55
Larynx (C32)	14.60	6.34	13.02	5.16
Trachea, lung, bronchus (C33–C34)	23.26	8.70	12.69	4.53
Cervix uteri (C53)	n/a	n/a	1.59	1.14
Kidney and renal pelvis (C64–C65)	2.72	1.73	1.29	1.05
Urinary bladder (C67)	3.27	2.09	2.22	1.89
Acute myeloid leukemia (C92.0)*	1.86	1.33	1.13	1.38
Cardiovascular diseases				
Coronary heart disease (I20–I25)				
Persons 35–64 years of age	2.80	1.64	3.08	1.32
Persons ≥65 years of age	1.51	1.21	1.60	1.20
Other heart disease (I00–I09, I26–I28, I29–I51)	1.78	1.22	1.49	1.14
Cerebrovascular disease (I60–I69)				
Persons 35–64 years of age	3.27	1.04	4.00	1.30
Persons ≥65 years of age	1.63	1.04	1.49	1.03
Atherosclerosis (I70)	2.44	1.33	1.83	1.00
Aortic aneurysm (I71)	6.21	3.07	7.07	2.07
Other arterial disease (I72–I78)	2.07	1.01	2.17	1.12
Respiratory diseases				
Influenza, pneumonia (J10–J11, J12–J18)	1.75	1.36	2.17	1.10
Bronchitis, emphysema (J40–J42, J43)	17.10	15.64	12.04	11.77
Chronic airways obstruction (J44)	10.58	6.80	13.08	6.78
* Data on medical expenses in Serbia not available				

Source: US Department of Health and Human Services (2014)

Table A4. Smoking-attributable fraction in Serbiain 2019 , by ICD-10 code, smoking status and age

		Current smokers					Former smokers				
Gender	ICD-10 code	35-44	45-54	55-64	65-74	75+	35-44	45-54	55-64	65-74	75+
F	C00-C14	60.5%	61.3%	59.8%	39.1%	27.0%	25.4%	21.8%	27.0%	35.1%	30.7%
M	C00-C14	81.2%	77.2%	76.5%	67.0%	60.2%	39.5%	55.2%	65.6%	71.6%	62.6%
F	C15	71.4%	72.0%	70.8%	51.1%	37.7%	35.6%	31.2%	37.7%	46.8%	41.9%
M	C15	73.6%	68.6%	67.8%	56.7%	49.4%	29.6%	44.3%	55.2%	61.9%	52.0%
F	C25	32.7%	33.4%	32.1%	17.0%	10.5%	9.7%	8.1%	10.5%	14.7%	12.3%
M	C25	35.5%	30.2%	29.4%	20.6%	16.2%	7.7%	13.6%	19.6%	24.4%	17.6%
F	C32	82.0%	82.4%	81.5%	65.6%	52.4%	50.2%	45.3%	52.4%	61.6%	56.8%
M	C32	86.1%	82.9%	82.4%	74.5%	68.5%	48.4%	63.9%	73.3%	78.4%	70.7%
F	C33-C34	81.4%	81.9%	80.9%	64.7%	51.4%	49.2%	44.3%	51.4%	60.7%	55.8%
M	C33-C34	90.9%	88.7%	88.3%	82.5%	77.9%	60.2%	74.1%	81.6%	85.4%	79.6%
F	C53	17.8%	18.2%	17.3%	8.3%	5.0%	4.6%	3.8%	5.0%	7.1%	5.9%
M	C53	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
F	C64-C65	9.4%	9.7%	9.1%	4.2%	2.4%	2.2%	1.9%	2.4%	3.5%	2.9%
M	C64-C65	44.2%	38.3%	37.5%	27.2%	21.8%	10.7%	18.5%	26.0%	31.7%	23.5%
F	C67	33.9%	34.6%	33.3%	17.7%	11.1%	10.2%	8.5%	11.1%	15.3%	12.9%
M	C67	51.4%	45.4%	44.5%	33.3%	27.1%	13.8%	23.3%	31.9%	38.3%	29.2%
F	I20-I25	42.6%	43.4%	41.9%	8.6%	5.2%	14.2%	11.9%	15.2%	7.4%	6.1%
M	I20-I25	44.8%	39.0%	38.1%	10.0%	7.6%	11.0%	18.9%	26.5%	12.1%	8.4%
F	I00-I09; I26-I28; I29-I51	15.3%	15.7%	14.9%	7.0%	4.2%	3.8%	3.2%	4.2%	6.0%	4.9%
M	I00-I09; I26-I28; I29-I51	25.5%	21.2%	20.6%	13.9%	10.7%	4.9%	8.9%	13.2%	16.7%	11.7%
F	I60-I69	51.3%	52.1%	50.6%	6.7%	4.0%	19.0%	16.1%	20.3%	5.7%	4.7%
M	I60-I69	48.1%	42.1%	41.2%	11.0%	8.4%	12.3%	20.9%	29.1%	13.3%	9.2%
F	I70	22.1%	22.7%	21.6%	10.6%	6.4%	5.9%	4.9%	6.4%	9.1%	7.6%
M	I70	38.5%	32.9%	32.2%	22.8%	18.0%	8.7%	15.2%	21.7%	26.8%	19.6%
F	I71	68.6%	69.3%	67.9%	47.8%	34.6%	32.7%	28.5%	34.6%	43.5%	38.7%
M	I71	70.4%	65.1%	64.3%	52.8%	45.5%	26.5%	40.5%	51.3%	58.2%	48.0%
F	I72-I78	29.1%	29.7%	28.5%	14.7%	9.0%	8.3%	6.9%	9.0%	12.6%	10.6%
M	I72-I78	30.2%	25.4%	24.7%	17.0%	13.2%	6.2%	11.0%	16.1%	20.2%	14.4%
F	J10-J11; J12-J18	29.1%	29.7%	28.5%	14.7%	9.0%	8.3%	6.9%	9.0%	12.6%	10.6%
M	J10-J11; J12-J18	25.8%	21.4%	20.8%	14.1%	10.9%	5.0%	9.0%	13.3%	16.9%	11.9%
F	J40-J42; J43	83.2%	83.6%	82.7%	67.5%	54.5%	52.3%	47.4%	54.5%	63.6%	58.8%

M	J40-J42; J43	89.4%	86.9%	86.4%	79.9%	74.7%	56.0%	70.7%	78.9%	83.1%	76.6%
F	J44	82.6%	83.1%	82.2%	66.6%	53.5%	51.3%	46.4%	53.5%	62.6%	57.8%
M	J44	82.2%	78.4%	77.8%	68.6%	61.9%	41.2%	57.0%	67.2%	73.1%	64.3%

Table A5. Number of deaths in Serbia in 2019, by ICD-10 code and age group

Gender	ICD-10 code	0-9	10-19	20-29	30-34	35-44	45-54	55-64	65-74	75+
F	C00-C14					8	9	12	38	54
M	C00-C14					11	43	133	123	73
F	C15					1	2	8	14	17
M	C15			1		3	18	51	55	40
F	C25			2		4	26	103	207	224
M	C25					11	41	157	257	174
F	C32						1	5	10	11
M	C32				1		18	94	141	87
F	C33-C34				1	24	124	484	638	348
M	C33-C34				5	27	220	1,076	1,620	682
F	C53			8	4	26	76	129	106	108
M	C53									
F	C64-C65			1		3	12	30	45	38
M	C64-C65				1	8	19	70	93	96
F	C67					2	10	22	70	93
M	C67					1	17	97	192	272
F	I20-I25		1		1	11	72	240	772	3,150
M	I20-I25			2	9	80	284	860	1,425	2,321
F	I00-I09; I26-I28; I29-I51	2	7	9	3	38	136	531	1,728	10,331
M	I00-I09; I26-I28; I29-I51	2	10	16	24	109	356	1,131	2,266	6,481
F	I60-I69			2	2	20	85	257	944	4,088
M	I60-I69	1	1	2	5	33	126	497	1,197	2,698
F	I70						6	19	104	1,108
M	I70					1	14	52	137	597
F	I71			1		1	5	14	31	52
M	I71					6	13	52	137	597
F	I72-I78							4	22	109
M	I72-I78					2	3	21	41	70
F	J10-J11; J12-J18	797	3	3	2	9	21	51	133	563
M	J10-J11; J12-J18	1,100	1	7	5	13	42	97	243	686
F	J40-J42; J43						1	2	5	24
M	J40-J42; J43					1		1	19	43

F	J44					6	26	129	248	535
M	J44			1	1	8	25	165	477	699

Source: Republic Fund for Health Insurance, authors' calculations

Table A6. Number of deaths caused by smoking and YWLL in Serbia in 2019 by age group

	35-39	40-44	45-49	50-54	55-59	60-64	35-65	65-75	75+	Total
Deaths	57	162	292	622	1,316	2,301	4,751	5,017	6,553	
YWLL	1,604	3,733	5,258	8,086	10,531	6,904	36,117			
YRLL							47,510	21,224	7,089	75,823

Table A7. Change in tobacco expenditure by income groups after tax increase

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.00%	0.03%	0.06%
Middle income	-0.09%	-0.06%	-0.04%
High income	-0.13%	-0.13%	-0.12%
Scenario 2 – tax increase 43.6%			
Low income	0.13%	0.29%	0.44%
Middle income	-0.32%	-0.19%	-0.05%
High income	-0.56%	-0.52%	-0.49%

Table A8. Change in medical expenditures by income group after tax increase

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.16%	0.19%	0.21%
Middle income	0.09%	0.11%	0.13%
High income	0.03%	0.04%	0.05%
Scenario 2 – tax increase 43.6%			
Low income	0.71%	0.82%	0.93%
Middle income	0.38%	0.48%	0.58%
High income	0.14%	0.17%	0.20%

Table A9. Change in productivity by income group after tax increase

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.19%	0.21%	0.24%
Middle income	0.10%	0.13%	0.15%

High income	0.04%	0.04%	0.05%
Scenario 2 – tax increase 43.6%			
Low income	0.81%	0.94%	1.06%
Middle income	0.43%	0.55%	0.67%
High income	0.16%	0.19%	0.23%

Table A10. Change in pension by income group after tax increase

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.17%	0.19%	0.22%
Middle income	0.09%	0.11%	0.14%
High income	0.03%	0.04%	0.05%
Scenario 2 – tax increase 43.6%			
Low income	0.72%	0.83%	0.94%
Middle income	0.38%	0.49%	0.59%
High income	0.14%	0.17%	0.20%

Table A11. Change in disposable income by income group after tax increase

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.35%	0.43%	0.51%
Middle income	0.09%	0.17%	0.25%
High income	-0.07%	-0.04%	-0.02%
Scenario 2 – tax increase 43.6%			
Low income	1.65%	2.04%	2.43%
Middle income	0.48%	0.84%	1.19%
High income	-0.27%	-0.16%	-0.06%

Table A12. Change in disposable income by income group after tax increase, with pensions included

Income group	Lower bound elasticity	Middle bound elasticity	Upper bound elasticity
Scenario 1 – tax increase 10%			
Low income	0.51%	0.62%	0.73%
Middle income	0.18%	0.28%	0.38%
High income	-0.03%	0.00%	0.02%
Scenario 2 – tax increase 43.6%			
Low income	2.38%	2.87%	3.37%
Middle income	0.87%	1.33%	1.79%
High income	-0.13%	0.01%	0.14%