



**tobaccotaxation**

Economic Research Informing  
Tobacco Taxation Policy



УНИВЕРЗИТЕТ У БАЊОЈ ЛУЦИ

UNIVERSITY OF BANJA LUKA

# Bosnia and Herzegovina Tobacco Excise Tax Modeling

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## List of Abbreviations

BD – Brčko district

BiH – Bosnia and Herzegovina

FBiH – Federation of Bosnia and Herzegovina

GDP – gross domestic product

GYST – Global Youth Tobacco Use Survey

IMF – International Monetary Fund

ITA – Indirect Taxation Authority

QALY – quality-adjusted life year

RR – relative risk

RS – Republic of Srpska

RSP – retail sales price

SAF – smoking-attributable fraction

SHS – secondhand smoke

STC-SEE – Survey on Tobacco Consumption in Southeastern Europe

UIC – University of Illinois Chicago

USA – United States of America

VAT – value-added tax

WHO – World Health Organization

## Abstract

### Background

Tobacco tax policy in Bosnia and Herzegovina currently assumes a gradual annual increase in the specific excise tax on cigarettes (0.15 BAM per year per pack). However, since 2019 policy makers in Bosnia and Herzegovina have frozen the increase in specific excise taxes. The Indirect Taxation Authority (ITA) increased the minimum excise in 2023 to 3.35 Bosnia-Herzegovina convertible marks (BAM) per pack, which is a change of 0.02 BAM compared to 2022. This research examines the effects of the increase in cigarette prices on government revenues from excise and indirect taxes, as well as the health impacts of tobacco tax increases.

### Methods

Based on the data on legal cigarette sales and the tax structure, we employ tobacco tax simulation modeling to estimate revenue change and the impact on public health. The baseline year for our analysis is 2023, and we conduct forecasts for the period of 2024–2025. The estimations of the impact of the proposed increased excise on government revenues are done by applying different scenarios regarding price and income elasticities on different price segments. We analyze the impact of the increased prices on public health through the decrease in prevalence and number of smokers.

### Results

An increase in the specific excise of 15 percent would lead to a price increase between 11.3 and 11.6 percent, on average, annually. The price increase would decrease the number of packs sold between 1.8 and 1.9 percent per year, on average, which would lead to an annual increase in total revenue between 9.2 and 11.7 percent. The price increase would lead to a decrease in smoking prevalence between 2.5 and 5.1 percentage points per year, on average. The number of saved lives (smokers who avoid premature death) would be between 10,748 and 21,342, on average, annually.

### Conclusion

Tobacco tax increases can lead to increases in revenues, decreases in smoking prevalence, and increases in the number of smoking-attributable deaths averted.

## Introduction

Tobacco use is one of the leading causes of preventable death in all countries, regardless of income level, though low-income countries and low-income people in any country are most affected. More than eight million people in the world died from a tobacco-related disease in 2019. Although on a global level smoking prevalence is decreasing (from 32.7 percent in 2000 to 22.3 percent in 2020), as is the absolute number of smokers in the world (from 1.37 billion in 2000 to 1.30 billion in 2020), the number of annual deaths is expected to keep growing since tobacco-related diseases slowly kill both its users and those exposed to secondhand smoke (SHS).<sup>1</sup>

Bosnia and Herzegovina (BiH) has about 3.28 million inhabitants and is located at the crossroads of south and southeastern Europe in the Balkan Peninsula. According to the World Bank classification, BiH is an upper middle-income country with a gross national income (GNI), per capita of 6,810 USD in 2021. The country is divided into two main entities, Republic of Srpska (RS) and Federation of Bosnia and Herzegovina (FBiH), and Brčko District (BD) is a self-administrative unit in BiH. FBiH is further divided into 10 cantons. Of the total population in BiH, about 62.85 percent live in FBiH, 34.79 percent in RS, and 2.37 percent in BD.

Tobacco tax in BiH consists of an ad valorem (42 percent of retail price) and a specific excise (0.84 EUR per pack of 20 cigarettes since 2019). After the introduction of the specific tax excise in 2009, it was increased gradually by 0.077 EUR per year per pack until 2019. In the years after 2019, policy makers in BiH decided to not increase specific excise taxes, stating they had achieved the threshold excise burden of 90 EUR per 1000 sticks. Cigarettes in BiH are much cheaper than in the EU, and because of the low prices their affordability is a problem. Therefore, there is significant space for tax policy improvement in BiH.

BiH ranks eleventh highest in the world in terms of smoking prevalence.<sup>2</sup> A survey of adults conducted in BiH in 2019 showed that 41.1 percent of adults were current smokers. Among daily smokers, more than 20 percent started smoking daily before the age of 18, while almost 60 percent started between the ages of 18 and 24. Almost half of current smokers smoke more than 20 cigarettes per day.<sup>3</sup>

While the most effective policy for reducing smoking prevalence is raising tobacco taxes, policy makers are reluctant to increase the tobacco excise tax—not only due to pressures from the tobacco industry, but also because of the belief that such an increase would reduce government revenue. Up to this point, we believe the absence of a reliable estimation of the impact of a tobacco excise tax increase on public revenue and public health has made it difficult for policy makers to confidently pursue an increase in tobacco taxes and use tax policy effectively to decrease tobacco consumption.

According to the literature, authors use a variety of instruments for tax simulations to estimate the effects of tobacco tax increases on different variables. Some authors highlight the health impacts of tax increases and present the changes in terms of smoking prevalence, mortality, and morbidity shares. For example, a California study used a combined index of morbidity and mortality known as the quality-adjusted life year (QALY) to estimate five health outcomes associated with tobacco tax

policies.<sup>i</sup> The study found decreases in use or initiation by 2–16 percent among adults by different groups.<sup>4</sup>

Research from Finland<sup>5</sup> concluded that with a comprehensive set of policies that involves taxation over a period between 2010 and 2040, smoking prevalence can be decreased by as much as 15 percent in the first few years and that by 2040, 1,300 deaths could be averted in that year alone. Similarly, an Ontario, Canada study<sup>6</sup> used the SimSmoke model, like Finland, to combine the effects of four strategies that would reduce smoking prevalence by 8.5 percent in 2035.

The aim of this research is to estimate the effects of tobacco excise tax increases on excise and total revenues, smoking prevalence, and number of saved lives. This study presents policy makers with reliable estimates of the impact of increased tobacco excise taxes on government revenues and on public health. The results suggest that increasing tobacco taxes could be an efficient tool for reducing smoking prevalence and could help the government collect more taxes.

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<sup>i</sup> The five health outcomes included: (1) the effects of price on smoking prevalence; (2) the effects of tobacco use on years of potential life lost; (3) the effects of tobacco use on quality of life (morbidity); (4) the integration of prevalence, mortality, and morbidity into a model of quality-adjusted life years (QALYs); and (5) the development of confidence intervals around these estimates.

## Methodology and Data Sources

Tobacco tax modeling is conceptually very easy, since it does not require complicated econometrics techniques or high-level calculations. Basic approaches to tax modeling are very similar, as they all include prices, quantities, and tax rates. These models are often referred to as a tax calculator in general revenue tax forecasting. The Ministry of Finance is generally interested only in the changes in revenue resulting from a tax change and not as much in the impacts on demand or consumption. On the other hand, the Ministry of Health is interested in the impacts on consumption of tobacco and on public health. The World Health Organization (WHO) primarily works with ministries of health, although the health impacts of tobacco tax policies can also benefit ministries of finance. If people are healthier, it will generally help governments save money and promote economic growth. However, for the Ministry of Finance, the primary goal remains revenue generation.

### Estimating the impacts of tobacco tax increases on tax revenues

Most governments cannot set prices directly, with a few exceptions. In BiH, cigarette prices are not directly affected by demand or other market factors. They are defined by the ITA, and they depend only on the tax policy. The tax changes are fully and exactly passed through to consumer prices.

The latest available data on the quantity of packs smoked are from the year 2021. Data for specific and ad valorem taxes that will be implemented are available for 2023, and there has been no change in excise taxes compared to 2021 (the last increase in excise has been made for 2019). The exception is the minimum excise, which increased from 3.33 BAM per pack in 2022 to 3.35 BAM per pack in 2023 (in 2021, the minimum excise was set at 3.04 BAM per pack). This increase in the minimum excise was insufficient to trigger a price increase. Since there was no change in taxes, cigarette prices have not changed since 2021, which is the last year for which we have detailed data on cigarettes consumed. Therefore, we can assume that the quantities sold have not significantly changed since 2021. For these reasons, we use 2023 as the baseline year for our analysis and forecast for the period 2024–2025. To calculate the government revenues in our baseline year, we apply the taxes from 2023 to our data on quantities sold from 2021.

The first step in tobacco modeling is to re-create the current system to verify data and model equations. In the second iteration we change the tax rates, and the new equilibrium will show the changes in consumption, tax revenues, and profits. Every model is based on a set of assumptions. The quality of the assumptions will determine the forecasting as well as the quality of the available data. For unbiased results it is necessary to test the sensitivity of the results to changes in the main assumptions. The data and necessary assumptions to re-create the current baseline system, along with their sources, are presented in Table 1.



**Table 4.** Data and assumptions for re-creation of the baseline model

Data			
Variable	Description	Source	Assumptions
RSP	Weighted average retail sales price (for premium, mid-range, and economy market segments)	ITA and authors' calculations	Calculated as the weighted average price (for premium, mid-range, and economy market segments) for the baseline year, and then recalculated for every year of estimation with new, increased indirect tax rates
SE	Specific excise per pack	ITA	Set at 1.65 BAM in the baseline year, with an assumed annual increase of 15%; indirect tax changes are fully and exactly passed through to consumer prices
ADv	Ad valorem	ITA	Set at 42% of RSP; we assume no change in the ad valorem rate from the baseline year
VAT	Value-added tax	ITA	Law on Value-Added Tax in Bosnia and Herzegovina has a standard tax rate of 17%; we assume no change in VAT rate from the baseline year
Qp	Number of packs (for premium, mid-range, and economy market segments)	ITA and authors' calculations	We calculate the number of packs for all three market segments by multiplying the total quantity of packs by the market share for each segment. The market shares are from our own calculations and are set at: 30.5% premium market segment, 38.2% mid-range market segment, and 31.2% economy market segment.
POP	Total adult population	Agency for Statistics of Bosnia and Herzegovina  International Monetary Fund (IMF)	Official statistics data for the adult population in 2019 are used as baseline data. For the following years they are corrected based on the demographics trends projected in the World Economic Outlook Database (IMF).
PRv (%)	Total adult prevalence	Survey on Tobacco Consumption in Southeastern Europe (STC-SEE)	The prevalence is estimated at 41.1% for 2019. Since we assume that there are no price or quantity changes, we assume the same prevalence of 41.1% in 2023. For 2024 and 2025 (forecasting years), the prevalence is calculated based on change in price and corresponding prevalence elasticities from the scenarios.
$E_{PRv,P}$	Prevalence elasticity, measures how much the prevalence responds to a change in price		We apply three scenarios. First, we apply the prevalence elasticity estimated for BiH. The prevalence elasticity is estimated at -0.563.

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		Zubović et al., 2019; Gligoric, et al., 2022	Second, we use the prevalence elasticity for Serbia. The prevalence elasticity is estimated at -0.265. Third, we use an average prevalence elasticity for the region of Southeastern Europe. The prevalence elasticity is estimated at -0.374.
MinExc	Minimum excise per pack	ITA	It is set at 3.35 BAM for the baseline year, with an assumed annual increase of the minimum excise of 2.46% from its baseline value. If the sum of the specific excise per pack and ad valorem is below this minimum value, then we use minimum excise per pack defined by ITA in our calculations. If not, we use the sum of the specific excise per pack and ad valorem as our total excise per pack. The assumption is that the indirect tax changes are fully and exactly passed through to consumer prices.
NoT	The NoT represents the net-of-tax portion, which is basically everything else but taxes. It includes margins and includes profits. The NoT is calculated as a residual, by subtracting all the various taxes on cigarettes from the RSP. $NoT = RSP - Excise - VAT$	Authors' calculations	Calculated for the baseline year as the residual, with an assumed increase equal to real GDP growth; annual real GDP growth rates are obtained from the IMF World Economic Outlook (14/10/2022): <ul style="list-style-type: none"> <li>• 2019 – 2.8%</li> <li>• 2020 – (-3.1%)</li> <li>• 2021 – 7.5%</li> <li>• 2022 – 2.4%</li> <li>• 2023 – 2%</li> <li>• 2024 – 3%</li> <li>• 2025 – 3%</li> </ul>
IlcMrk	The illicit market represents the portion of the total market outside the legal channels of distribution. No taxes nor excises are paid in the illicit market	Gligoric et al., 2021	We assume the illicit market share is constant at 18.1% of the total market and the legal market is 81.9% of the total market for the baseline year and every year of the simulation.
$E_{d,p}^{pr}$	Own-price elasticity measures how much the quantity demanded responds to a change in price. Demand for a good is said to be <i>elastic</i> if the quantity demanded responds substantially to changes in price.	Gligoric et al., 2022; Tauras et al., 2006; Zubović et al., 2019	We apply three scenarios. First, we use own-price elasticity, based on the Household Budget Survey data for a mid-range brand, and we assume the elasticities for the premium and economy market segments. The price elasticities are estimated at -1.013 for the mid-range segment, -0.343 for the premium segment, and -1.14 for economy segment. Second, we use elasticities estimated

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	<p>Demand is said to be <i>inelastic</i> if the quantity demanded responds only slightly to changes in price.</p>		<p>for Serbia. The price elasticities are estimated by income group at -0.631 for the middle-income group, -1.076 for the low-income group, and -0.22 for the high-income group. Third, we use the average elasticities for the region of Southeastern Europe. The price elasticities are estimated at -0.747 for the middle-income group, -1.087 for the low-income group, and -0.5 for the high-income group.</p>
$E_{d,I}^{pr}$	<p>Income-elasticity measures how the quantity demanded changes as consumers income changes. It is calculated as the percentage change in quantity demanded divided by the percentage change in income.</p>	<p>Gligoric et al., 2022; Tauras et al., 2006; Zubović et al., 2019</p>	<p>We apply three scenarios. First, we use income elasticity, based on the Household Budget Survey (HBS) data for a mid-range brand, and we assume the elasticities for the premium and economy market segments. Income elasticity, based on the HBS data, is estimated at 0.81. The income elasticities are estimated at 0.81 for the mid-range segment, 0.274 for the premium segment, and 0.911 for the economy segment. Second, we use elasticities estimated for Montenegro. The income elasticities are estimated at 0.522 for the middle-income group, 0.514 for the for the low-income group, and 0.607 for the high-income group. Third, we use the average elasticities for the region of Southeastern Europe. The income elasticities are estimated at 0.966 for the middle-income group, 1.148 for the low-income group, and 0.636 for the high-income group.</p>
$E_{d1,p2}^{pr}$	<p>Cross-price elasticity measures how the quantity demanded of one good responds to a change in the price of another good. It is calculated as the percentage change in quantity demanded of good one divided by the percentage change in the price of good two.</p>	<p>Tauras et al., 2006</p>	<p>Due to a lack of data, we are unable to estimate the cross-price elasticities for BiH, so we adopt them from the literature:</p> <ul style="list-style-type: none"> <li>• cross-price elasticities for the mid-range market segment with respect to premium and economy cigarettes are 0.62 and 0.06, respectively;</li> <li>• cross-price elasticities for the premium market segment with respect to mid-range and economy cigarettes are 0.15 and 0.01, respectively; and</li> </ul>

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			<ul style="list-style-type: none"> <li>• cross-price elasticities for the economy market segment with respect to premium and mid-range cigarettes are 0.27 and 0.13.</li> </ul>
TOTC	Total consumption (10 <sup>6</sup> sticks) includes both legal and illegal markets. It is a sum of the Qp and IICMrk: TOTC=Qp+ IICMrk	Gligoric et al., 2021, and ITA	Total consumption is the sum of legal and illicit consumption. We estimate the size of the illicit market in 2019 was 18.1% of the total consumption, and we assume that it remains constant.

Because of a lack of data, we are unable to estimate the own-price elasticity, income elasticity, and cross-price elasticity for different market segments. For this reason, we use estimations from other studies. We estimate the own-price elasticity and income elasticity for the entire population. We run three different scenarios involving own-price elasticity and income elasticity. The three scenarios are necessary as a sensitivity analysis to prove that our results are robust to changes in our assumptions. We apply a similar methodology for our calculations of own-price and income elasticities for different market segments.

In our first scenario, for own-price elasticity for different price segments, we assume that demand for premium (economy) brands is less (more) sensitive to price changes, following Chalak et al., 2023<sup>7</sup>. We use our price elasticity as an elasticity of the mid-range brand, and, based on Tauras et al., 2006, we assume elasticities for premium and economy price segments. Tauras et al. estimate the own-price elasticities for premium, discount, and deep discount cigarettes at -0.19, -0.56, and -0.63, respectively. We calculate the ratios between premium and discount price cigarette elasticities and between deep discount and discount price cigarette elasticities. We then apply these ratios to our own mid-range price elasticity to obtain elasticities for the premium and economy market segments.

We calculate income elasticity for the premium and economy market segments in a similar manner. For our second scenario on own-price elasticity and income elasticity, we apply elasticities by income group from two countries in the region (Serbia and Montenegro) with the lowest estimated elasticities and assume that elasticities by income group correspond to those by price segment. Finally, for our third scenario, we use the average own-price elasticity and income elasticities by income group for the region of Southeastern Europe.

For prevalence elasticity, we also apply three scenarios. In the first scenario, we use the prevalence elasticity estimated for BiH, while in the second scenario we use the elasticity for Serbia. Finally, in the third scenario, we use average elasticity for the region of Southeastern Europe.

For cross-price elasticity, we run only one scenario. The reason for this is that cross-price elasticity is very difficult to estimate, mainly due to the lack of data. Only a few countries have the data that are necessary for cross-price elasticity estimation. In such situations where literature is scarce, and in the

absence of any real data, it is safer not to make too many arbitrary assumptions on trending down or up. Therefore, we adopt all cross-price elasticities from Tauras et al., 2006.

The market shares for the premium, economy, and mid-range segments are the results of our own calculations. The ITA provides the number of packs of cigarettes sold, with their prices. We calculate the weighted average price for the baseline year. Next, we calculate the shares for each market segment, based on the minimum (4.9 BAM), maximum (10 BAM), and weighted average prices (5.6 BAM). The premium market share is 30.5 percent, and it includes a price range of 6–10 BAM. The mid-range segment is 38.2 percent, and it includes a price range of 5.4–5.8 BAM. The economy segment is 31.2 percent, and it includes a price range of 4.9–5.3 BAM.

In the study that estimated the size of the illicit market in BiH in 2019, the illicit market for manufactured cigarettes was estimated at 18.1 percent (Gligoric et al., 2021). In the same study, price increase was identified as a variable with statistically insignificant impact on the illicit market. For this reason, and because of the absence of any estimates of the illicit market since, we assume the illicit market share is 18.1 percent of the total market and the legal market share is 81.9 percent for the baseline year and for every year of the simulation.

To re-create the current system, the first step is to break down the retail sales price (RSP):

$$RSP = SE + ADV + VAT + NoT$$

To calculate the total tax per pack, we need to calculate total excise per pack. Total excise per pack includes the specific excise per pack and the ad valorem.

The ad valorem tax per pack is calculated by applying the following formula for all three market segments:

$$ADV = 0.42 * RSP$$

The minimum excise per pack is 3.04 BAM. In our case, the sum of the ad valorem and specific excise taxes is over this minimum amount. This is the case for our baseline year and for every year of the simulation. So, we use the sum of the specific excise per pack and the ad valorem as a total excise per pack for all three market segments.

The VAT per pack is calculated as:

$$VAT = \frac{(RSP * 0.17)}{1 + 0.17}$$

The total tax per pack for all three market segments is calculated as:

$$TOT TAX = VAT + ADV + SE$$

where *TOT TAX* represents the total tax per pack.

We obtain the total excise revenue by applying the following expression for all three market segments:

$$TOT EXR = \sum_{i=1}^3 (ADV_i + SE_i) * Q_{pi}$$

where *TOT EXR* represents the total excise revenue and *i* represents the market segments. We obtain the total revenue from taxes in a similar way:

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$$TOT TAXR = \sum_{i=1}^3 (ADV_i + SE_i + VAT_i) * Qp_i$$

where *TOT TAXR* represents the total revenue from taxes, and *i* represents the market segments. The total market value is obtained by applying the following expression:

$$TOT MARV = \sum_{i=1}^3 RSP_i * Qp_i$$

where *TOT MARV* represents the total market value and *i* represents the tiers.

In Table 2, we present the results for our baseline year, which are fully based on the real data.

**Table 5.** Baseline model (2023)

Market segment	Price per pack (BAM)	Quantity of packs (thousands)	Market share	Total excise revenue (thousands, in BAM)	Total revenue (thousands, in BAM)	Total market value (thousands, in BAM)
Premium	6.11	61,290	31%	258,390.78	312,795.72	374,434.00
Mid-range	5.58	76,680	38%	306,177.00	368,328.71	427,750.00
Economy	5.12	62,680	31%	238,078.20	284,662.56	320,610.00
Total or avg. (weighted)	5.60	200,650	100%	802,645.98	965,786.99	1,122,794.00

The total number of packs sold in 2021 was over 200 million, which yields total excise revenue greater than 800 million BAM and total revenue (including VAT) greater than 950 million BAM.

In the second iteration, we apply the higher tax rates and simulate the impact of the higher taxes on quantities of packs sold and on revenues. Our simulations cover the 2024–2025 period. Based on Equation (1), the new RSP after a specific tax increase is calculated as:

$$RSP_2 = (NoT_2 + ADV * RSP_2 + SE_2) * (1 + 0.17)$$

where *RSP<sub>2</sub>* stands for the new retail sale price and *SE<sub>2</sub>* stands for the new, increased specific excise.

The *NoT<sub>2</sub>* is calculated as a residual from previous expression and increased for the real GDP growth for all three market segments.

The new ad valorem tax per pack is calculated for all three market segments as:

$$ADV_2 = 0.42 * RSP_2$$

The new total excise per pack for all three market segments is calculated as:

$$NTE = ADV_2 + SE_2$$

where *NTE* stands for new total excise.

The new VAT per pack for all three segments is calculated as:

$$VAT_2 = RSP_2 * \left(\frac{0.17}{1.17}\right)$$

The new total tax per pack is obtained as:

$$TOT TAX_2 = VAT_2 + NTE$$

When we calculate the *RSP<sub>2</sub>*, the new total excise per pack, and the new VAT, we need to simulate the new quantities of cigarette packs. To do so, we apply the elasticities from Table 3. Calculation of the new number of packs will be different for premium, mid-range, and economy market segments. This

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is because we need to consider individuals who are moving from the premium market to mid-range, from mid-range to economy, and those individuals who are taken out from the tax base due to an increase in  $RSP_2$ . The procedure to calculate the new number of packs for a premium market segment is presented in following expression :

$$NQ_p = Q_p * \left( 1 + \frac{RSP_2^p}{RSP_1^p} * E_{d,p}^{pr} + \frac{RSP_2^{mr}}{RSP_1^{mr}} * E_{d,pmr}^{pr} + \frac{RSP_2^e}{RSP_1^e} * E_{d,pe}^{pr} + GDP * E_{d,l}^{pr} \right)$$

where  $NQ_p$  stands for the new number of packs for the premium segment. To calculate the new number of packs for the mid-range segment, we apply the following procedure:

$$NQ_{mr} = Q_{mr} * \left( 1 + \frac{RSP_2^{mr}}{RSP_1^{mr}} * E_{d,p}^{mr} + \frac{RSP_2^p}{RSP_1^p} * E_{d,ppr}^{mr} + \frac{RSP_2^e}{RSP_1^e} * E_{d,pe}^{mr} + GDP * E_{d,l}^{mr} \right)$$

where  $NQ_{mr}$  stands for the new number of packs for the mid-range segment. To calculate the new number of packs for the economy segment, we apply the following procedure:

$$NQ_e = Q_e * \left( 1 + \frac{RSP_2^e}{RSP_1^e} * E_{d,p}^e + \frac{RSP_2^p}{RSP_1^p} * E_{d,ppr}^e + \frac{RSP_2^{mr}}{RSP_1^{mr}} * E_{d,pmr}^e + GDP * E_{d,l}^e \right)$$

where  $NQ_e$  stands for the new number of packs for the economy segment.

The new total excise revenue is obtained as:

$$TOTEXR_2 = \sum_{i=1}^3 NTE_i * NQ_i$$

where  $TOTEXR_2$  represents the new total excise revenue and  $i$  represents the tiers.

We obtain the new total revenue from taxes similarly:

$$TOTTAXR_2 = \sum_{i=1}^3 (NET_2 + VAT_2) * NQ_i$$

where  $TOTTAXR_2$  represents the new total revenue from taxes, and  $i$  represents the tiers. The total market value is obtained by applying the following expression:

$$TOTMARV_2 = \sum_{i=1}^3 RSP_i * NQ_i$$

## Estimating the impacts of tobacco tax increases on public health

The general impacts of tobacco tax increases are categorized into the following two main health-related segments:

1. decrease in smoking prevalence because of higher prices and
2. increase in number of quitters who avoid premature death.

Data required for the basic calculation are:

- total consumption (million sticks) per year,
- total adult population (in millions), and
- total adult prevalence (percentage).

For the purpose of this analysis, the baseline year is 2023. Data on legal consumption for 2019 and 2020 are collected from the ITA<sup>ii</sup> and estimated for the years 2021-2025. The total market (legal and illegal) for each year is obtained by adding the illegal market (18.1 percent of total) to the legal

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<sup>ii</sup> Indirect Taxation Authority. (2020). Data obtained on request of the BiH research team (statistics of issued excise stamps).

numbers. The following analysis shows the impact of price increases on total adult prevalence and on the number of smokers who avoid premature death.

Total adult population statistics is from the Agency of Statistics of Bosnia and Herzegovina as well as from local entity and BD statistics agencies/offices. Total adult prevalence is obtained from the study STC-SEE.<sup>iii</sup> Data and assumptions necessary for this analysis are presented in Table 3.

**Table 6.** Data and assumptions for health modeling

Description	Source	Data and assumption
Total deaths in BiH, ages 35+	Agency for Statistics of BiH and entity/BD agencies of statistics	We use the official statistics data on the number of total deaths in the baseline year and then estimate total deaths for the following years by using a simple linear function.
% of quitters who avoid premature death	Hanafy et al., 2010; Yürekli et al., 2010; Quimbo et al., 2012; Barkat et al., 2012; Burki et al., 2013; John et al., 2010	Based on the evidence from the epidemiological studies, we assume that 70% percent of those who quit smoking would avoid premature death by quitting.

Total consumption in 2023 is 4.9 billion sticks, including both licit and illicit cigarettes. The estimated adult smoking prevalence is 41.1 percent, while the assumed number of quitters who avoid premature death is 70 percent. Because we have three scenarios for our tax modeling, we run three scenarios for the impacts of price increases on health.

The number of smokers in the baseline year ( $n-1$ ) is obtained by multiplying the total adult population by the adult smoking prevalence rates in the baseline year (41.1 percent). The same formula is used for the following years by multiplying total population and prevalence for each year.

Prevalence in the first observed year of the model ( $n$ ) is obtained with the formula:

$$Pr_n = Pr_{n-1} [1 + PCh * PEI]$$

where  $Pr_n$  is prevalence in the observed year,  $Pr_{n-1}$  is prevalence in the baseline (previous) year,  $PCh$  is price increase in the observed year, and  $PEI$  is prevalence elasticity.

To calculate the number of smokers who avoid premature death, we use this formula:

$$SaPD = (NSM_{n-1} - NSM_n) * PCA$$

where  $SaPD$  stands for the number of smokers who avoid premature death,  $NSM_n$  is the number of smokers in the observed year,  $NSM_{n-1}$  is the number of smokers in the baseline (previous) year, and  $PCA$  is percent chance assumption (70 percent, based on other research).

<sup>iii</sup> Deep Dive. (2019). Survey on Tobacco Consumption in Southeastern European countries (STC-SEE) data for 2019.



## Results

### Impacts of tobacco tax increases on tax revenues

As mentioned above, we assume three scenarios of price elasticity in the tobacco excise tax modeling. The comparison of the three scenarios is presented in Table 4.

**Table 7.** Scenario comparison

	First scenario		Second scenario		Third scenario	
Years	Total revenue from indirect taxes (BAM)					
	Amount	Δ%	Amount	Δ%	Amount	Δ%
2023	965,787		965,787		965,787	
2024	1,054,661	9.2%	1,075,237	11.3%	1,071,250	10.9%
2025	1,153,266	9.3%	1,200,509	11.7%	1,190,403	11.1%
Years	Total excise revenue (BAM)					
	Amount	Δ%	Amount	Δ%	Amount	Δ%
2023	802,646		802,646		802,646	
2024	878,515	9.5%	895,613	11.6%	892,367	11.2%
2025	962,709	9.6%	1,002,065	11.9%	993,783	11.4%

Source: Authors' calculations

We estimate that a 15-percent tax increase would lead to an annual increase of between 9.5-percent and 11.9-percent in excise tax revenues in 2024 and 2025. The second scenario yields the highest annual increase in the excise, with total revenue increase of 11.7 percent and 11.5 percent on average, respectively. The assumed increase in the specific excise tax would result in the highest annual decrease in the quantities of packs sold, by 3 percent, under the first scenario assumptions (Appendix Table A1).

### Tobacco tax increases impacts on health

Assuming the same three simulations as above, the estimated impacts of price increases on smoking prevalence and the number of smokers who avoid premature death are presented in Table 5.

The results show that a price increase between 11.3 percent and 11.56 percent, on average annually, would reduce prevalence between 3.42 percent and 5.12 percent. Adult prevalence would decrease on average by 3.67 percentage points between 2023 and 2025. Under the assumption that 70 percent of quitters would avoid premature death, this price increase would lead to an annual reduction of premature deaths caused by smoking of between 10,748 and 21,342 annually.

**Table 8.** Impacts of price increases on smoking prevalence and number of smokers who avoid premature death, three scenarios

	First scenario			Second scenario			Third scenario		
	2023	2024	2025	2023	2024	2025	2023	2024	2025
<b>Cigarettes smoked (mil. sticks)</b>	4,900	4,753	4,609	4,900	4,844	4,795	4,900	4,830	4,761
<b>Prevalence</b>	<b>41.10%</b>	<b>38.49%</b>	<b>35.98%</b>	<b>41.10%</b>	<b>39.86%</b>	<b>38.63%</b>	<b>41.10%</b>	<b>39.37%</b>	<b>37.68%</b>
<b># smokers (in mil)=pop (in mil)*prev</b>	1.18	1.10	1.03	1.18	1.14	1.10	1.18	1.13	1.08
<b>Change in # smokers (in thousands)</b>		77.84	74.60		77.84	74.60		49.54	48.57
<b>% change in # smokers</b>		6.6%	6.8%		3.3%	3.4%		4.2%	4.3%
<b>40% would die prematurely</b>	1,225	31,136	29,842	1,225	15,394	15,315	1,225	19,815	19,429
<b># smokers who avoid premature death</b>		21,795	20,889		10,776	10,720		13,870	13,600

Source: Authors' calculations

## Limitations of the Study

The most significant limitation of the research is the fact that there is no possibility for calculation of price and income elasticities for different price segments, so it is necessary to use estimations from other studies. For this reason, we model the three scenarios to add additional checks to the robustness of our results.

Another limitation in our work is the lack of more recent data on the illicit market. We estimate the illicit market in 2019, and we assume no decline in tax-paid cigarette sales due to a price increase. Basically, we assume that the illicit market is at 18.1 percent of the total market, and the legal market is at 81.9 percent of the total market for every year of the simulation.

## Summary, Discussion, and Conclusion

This research estimates the impacts of a specific excise tax increase on government revenues and the impacts of the corresponding price increase on public health in BiH. This study is the first one of its kind in BiH. For this purpose, a variety of databases are combined and used to estimate the cost of smoking by gender, age groups, diseases, and entities.

Our analysis covers the 2023–2025 period. There are many limitations, one of which is that we are unable to calculate the elasticities for different price segments. Therefore, we use estimations from other studies. As a check of robustness of the main finding, we perform sensitivity analyses by running three scenarios. The scenarios differ only in our estimations of own-price elasticity and income elasticity. All three scenarios predict that an increase in the specific excise tax would increase prices of cigarettes, decrease consumption, and increase government revenues. The consistency of our results strongly suggests that they are robust. The first scenario yields the highest annual decrease in the quantity of packs, at 3 percent annually. Regarding government revenues, the second scenario yields the highest annual increase in the excise and total revenue of 11.7 percent and 11.5 percent on average, respectively.

The general impacts of tobacco tax increases would present in two main health-related segments: a decrease in smoking prevalence because of higher prices and an increase in the number of quitters who avoid premature death. All three scenarios predict that an increase of the specific excise tax would increase tobacco prices by 11.43 percent on average, which would decrease total adult smoking prevalence and the number of smokers. Again, the consistency of results across scenarios strongly suggests that our results are robust. The first scenario yields the highest decrease in total adult prevalence of 5.12 percentage points. The predictions from the first scenario also show the highest decrease in the number of smokers, by 6.7 percent on average, and the highest number of smokers who avoid premature death, at 21,349.

Based on the findings of this study, the following policy recommendations are offered to policy makers:

- The government should reintroduce the regular annual increase of the tobacco excise tax—which was abandoned in 2019—but more aggressively, as doing so would lead to an increase of excise revenue and total revenue. This annual increase should at least assure no increase in affordability of cigarettes.
- Moreover, a significant annual increase of the tobacco excise tax would decrease consumption of tobacco and exposure to secondhand smoke, encourage smoking cessation, and discourage smoking initiation particularly among youth, thereby leading to thousands of smoking-attributable deaths averted.

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## APPENDIX

**Table A**Error! Main Document Only.. Excise tax modeling, first scenario

	2023	2024	2025
Weighted average price (BAM)	5.6	6.21	6.9
% change		11.3%	11.6%
Quantity of packs (thousands)	200,650	194,650	188,756
% change		-3.00%	-3.00%
Total excise revenue (BAM)	802,646	878,515	962,709
% change		9.5%	9.6%
Total revenue (BAM)	965,787	1,054,661	1,153,266
% change		9.2%	9.3%

Source: Authors' calculations

**Table A**Error! Main Document Only.. Excise tax modeling, second scenario

	2023	2024	2025
Weighted average price (BAM)	5.6	6.22	7.00
% change		11.4%	11.6%
Quantity of packs (thousands)	200,650	198,363	196,342
% change		-1.1%	-1%
Total excise revenue (BAM)	802,645.98	895,613	1,075,237
% change		11.6%	11.3%
Total revenue (BAM)	965,786.99	1,002,065	1,200,509
% change		11.9%	11.7%

Source: Authors' calculations

**Table A**Error! Main Document Only.. Excise tax modeling, third scenario

	2023	2024	2025
Weighted average price (BAM)	5.6	6.21	6.90
% change		11.2%	11.5%
Quantity of packs (thousands)	200,650	197,782	194,964
% change		-1.4%	-1.4%
Total excise revenue (BAM)	802646	892,367	993,783
% change		11.2%	11.4%
Total revenue (BAM)	965,787	1,071,250	1,190,403
% change		10.9%	11.1%

Source: Authors' calculations