



**tobaccotaxation**

Economic Research Informing Tobacco Taxation Policy

**Impacts of Tobacco Excise Increases on Cigarette  
Consumption and Government Revenues  
in Southeastern European Countries**

**Regional study**

**Albania, Bosnia and Herzegovina, Kosovo,  
Montenegro, North Macedonia, and Serbia**

**2019**

### Disclaimer

This report is co-authored by the following research institutions: Institute of Economic Sciences, Belgrade, Serbia; University of Banja Luka, Entrepreneurship and Technology Transfer Center, Banja Luka, Bosnia and Herzegovina; Analytica, Skopje, North Macedonia; Development Solutions Associates, Tirana, Albania; Democracy Plus, Prishtina, Kosovo; The Institute of Socioeconomic Analysis, Podgorica, Montenegro. These institutions are working in cooperation with the Institute of Economic Sciences from Belgrade, which is coordinating a regional network of researchers in Southeastern Europe on tobacco taxation. The project is funded by the University of Illinois at Chicago's (UIC) Institute for Health Research and Policy to conduct economic research on tobacco taxation in Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia. UIC is a partner of the Bloomberg Initiative to Reduce Tobacco Use. The views expressed in this document cannot be attributed to, nor do they represent, the views of UIC, the Institute for Health Research and Policy, or Bloomberg Philanthropies.

### Acknowledgments

The report is the culmination of the efforts of 18 authors, who are listed below along with the editors. We would also like to acknowledge the following individuals for their constructive reviews of the report: Frank J. Chaloupka, Ph.D.; Erika Siu, JD, LL.M.; and Violeta Vulović, Ph.D, from the Institute for Health Research and Policy in the University of Illinois at Chicago, Illinois, United States.

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## Executive summary

Consumption of tobacco products, especially cigarettes in Southeastern Europe (SEE) imposes a significant economic burden on households and society in general. This report examines increases in the price of cigarettes through tobacco excise increases and their associated impacts on tobacco consumption, household expenditures, and tax burdens in different income groups as well as the impact of these increases on government revenues.

Using secondary data from household budget surveys (HBS) for periods ranging from 3 to 12 years, depending on data availability, in six countries (Albania, Bosnia and Herzegovina (B&H), Montenegro, North Macedonia, Kosovo, and Serbia), this research estimates the price and income elasticity of smoking prevalence and intensity, both for the full population and by income group.

For all countries studied, this research finds that price increases achieved through an increase in tobacco excises would result in lower consumption, higher budget revenues, and positive redistribution effects. In order to maximize the effectiveness of tobacco taxation policies, country specifics such as income growth, different elasticities, and behavioral responses of different income groups should be considered when designing policy. The findings are outlined in greater detail below:

### **Increasing excises (that results in the increase of cigarette prices) will result in lower cigarette consumption**


Results suggest that in all countries studied, a price increase of cigarettes will result in lower cigarette consumption. Therefore, if the excise increase leads to a price increase, tobacco consumption in the region will decrease. In most of the countries, the decrease in consumption stems from both a decrease in smoking prevalence and a decrease in the consumption of cigarettes by those who smoke. Prevalence elasticities range from as much as -0.636 in Montenegro to -0.165 in Albania, while in Kosovo prices do not impact the decision to smoke. Total elasticities range from -1.065 in Montenegro to -0.387 in Kosovo. The income elasticities range from 0.595 in North Macedonia up to 1.113 in Albania. Given that income elasticities in all countries studied are high, the response of consumers to excise increases will depend on the rate of income growth. Therefore, when designing the excise increase, policymakers should take into account the expected growth of income in the country. In other words, the increase of excises will result in lower consumption of cigarettes if it reduces the affordability of cigarettes.

### **An increase in cigarette excises will result in an increase in government revenue**

In addition, the change in government income from taxes levied on cigarettes is simulated for a scenario in which retail prices would increase either by changing the excise tax or by simultaneously changing the tax and producers' price. In all the countries the price increase would result in increased budget revenue.

The change in budget revenue would be the highest in Kosovo, with an estimated increase of 26 percent as a result of a price increase of 25 percent, followed by Serbia and Albania with over 17 percent increased revenues. The lowest increase in budget revenues could be expected in B&H, due to a very high price elasticity, where an increase in the specific excise of 25 percent (which would lead to a 17 percent price increase) would result in a 2.5 percent increase in budget revenues. In the long-run, further positive fiscal effects could be expected since the decrease in cigarette consumption will likely lower health expenditures related to the harmful effects of cigarettes.

These research findings suggest that claims about the negative impact of excise increase on budget revenues fueled by the industry are not based on rigorous evidence. Thus, even if a narrow analysis is applied, focusing strictly on budgetary impact, there are still positive fiscal effects.

 **In most of the countries studied, an increase in cigarette excises would have an additional redistributive effect.**

Total demand elasticities among low-, middle-, and high-income households have proven to be significantly different. In most countries, low-income households have the highest price elasticity, and high-income households have the lowest. As a result, the cigarette price increase is followed by the largest reduction in consumption in low-income households. Unlike the middle- and high-income groups, low-income households also reduce their total expenditures on cigarettes which also has positive effect on their living standard. In the long-run, further redistributive effects could be expected, as lower consumption of cigarettes will benefit the health of low-income households and decrease their expenditures for tobacco-related illnesses. On the other hand, policy makers should also bear in mind that low-income households are at the same time the most sensitive with regard to changes in their income. Research results show that the income increase would be associated with a comparatively higher increase in consumption within the low-income group. Therefore, improved taxation policy should be designed to include eventual changes in income.

These research results refute the fallacy, often promoted by the tobacco industry, about regressive effects of tobacco taxes. Research in all countries shows that tobacco excise increases would have a progressive effect as the additional tax burden is the lowest for low-income households and the highest for most high-income households, whereas in some countries the share of budget expenditures for cigarettes among low-income households is actually decreased.

## 1 Introduction

This report presents the research findings from the second research year of the project “*Accelerating Progress on Effective Tobacco Tax Policies in Low- and Middle-Income Countries*”. The research was undertaken in six middle-income countries in Southeastern Europe (SEE): Albania, Bosnia and Herzegovina (B&H), Kosovo, North Macedonia, Montenegro, and Serbia. The research was conducted in 2019. The same research methodology was used in all the countries and applied on secondary data from the Household Budget Survey (HBS), thereby providing a comparative analysis for all the countries. The research includes three topics of analysis, performed as follows:

1. Using HBS data, estimate the cigarette price elasticity of demand on the extensive (in other words, prevalence elasticity) and the intensive margin (in other words, conditional demand (intensity) elasticity);
2. Using HBS data, estimate the cigarette price elasticity of demand by income group;
3. Simulate the impact of an increase in tobacco excise and price on consumption and government revenue.

This report builds on the theoretical framework of the two-part model developed by Mullahy and Manning<sup>1</sup>. This model estimates the overall demand elasticity as a (corrected) sum of two elasticities: prevalence elasticity and conditional demand (in other words, intensity) elasticity. The prevalence elasticity is estimated via a logit model. The Deaton model and Generalized Linear Model (GLM) are used for the estimation of conditional demand (intensity). The GLM is used as a robustness check (detailed explanation of the Deaton model and the general methodology is presented in chapter 2).

First, the described analyses are performed separately for each country on the overall sample of households. The sample of households is then split into three equal groups: low-, middle-, and high-income groups with the same analyses performed on income subsamples and then, results are compared. Finally, the estimated elasticities are utilized to simulate the effect of price increases on overall cigarette consumption and government revenues.

The remaining part of the report is structured as follows. Chapter 2 describes the methodology used in the analysis, while chapters 3-8 present and discuss the results by country. The report concludes with chapter 9. Supporting tables from chapters 3-8 are included in the appendix, which is available on the online project web page (<http://tobaccotaxation.org/>).

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<sup>1</sup> Manning, W. G., and J. Mullahy. (2001) “Estimating Log Models: To Transform or Not to Transform?” *Journal of Health Economics* 20, no. 4: 461–494.

## 2 Data and methodology

This chapter describes the data and methodology used in the report. More precisely, it outlines the methodology used to estimate the price participation and intensity (conditional) elasticity of cigarettes. In addition, this chapter discusses the methodology for the estimation of price elasticity at different income levels. The estimates are then used to simulate the impact of a price increase on consumption and government revenue. The same econometric models and simulation methods are applied in all the countries. However, due to slight differences in available data and country specifics, there are minor variations in model specification and years of available data.

All analyses use microdata from HBS data to estimate the price and income elasticities of cigarette use. HBS, an annual survey, provides detailed information on household consumption, as well as on individual characteristics of household members. The price elasticities (and the effects of other variables) are estimated at the household level because information on cigarette consumption is collected for the household as a whole. Table 2.1 reports the available years for the analysis in each country.

*Table 2.1: Household Budget Survey data available for each country*

Country	Years available
Albania	2014-2017
Bosnia and Herzegovina	2007, 2011, 2015
Kosovo	2007-2017
Montenegro	2006-2015 and 2017
North Macedonia	2015-2017
Serbia	2006-2017

The methodology applied in each of the research topics is described below.

### 2.1 Estimation of the price elasticity of demand

Cigarette consumption is often characterized by a mixed distribution that is partly discrete and partly continuous. More precisely, cigarette consumption is characterized by a large proportion of non-smokers, for which the variable describing the consumption takes a zero value and the remaining outcomes that are strictly positive. More formally, the distribution can be expressed as

$$\begin{aligned}
 y=0, n = 0, 1, \dots, n_i \\
 y>0, n = n_i+1, n_i+2, \dots, n_N
 \end{aligned}
 \tag{1}$$

The distribution reflects the fact that when faced with the market prices and their own budget constraints and given the utility that they derive from cigarettes used, households are facing two decisions. The household first decides whether to smoke or not smoke (extensive margin). If the household decides to smoke, they then decide how many cigarettes to smoke (intensive margin).

The literature suggests a two-part model to independently model the two decisions<sup>2</sup>. This model is well suited for cigarette use, as the proportion of non-smokers ( $y=0$ ) globally is high. The World Health Organization (WHO) estimates the proportion of smokers to be approximately 21 percent.<sup>3</sup> The first part of the model estimates cigarette prevalence. It estimates the probability of observing positive tobacco consumption (vs. no consumption), conditional on the set of independent variables. The model is typically estimated by a parametric binary probability model, such as logit or probit. The second part of the model deals with the intensity (level) cigarette consumption. The model estimation is conditional on  $y_i > 0$ , where the dependent variable is typically a linear function of independent variables. Therefore, it can be estimated via an ordinary or a generalized linear model.

The main variables that enter both models are price and income. These two variables provide the basis for the calculation of price elasticity, income elasticity of cigarette prevalence and the intensity of cigarette use. Since HBS data do not contain the prices of cigarettes, unit values are used as a proxy for prices. The unit values are calculated as the ratio between total household expenditure on cigarettes (in local currency) and total household consumption on cigarettes (in cigarette packs). However, a potential identification problem arises by using this proxy because of the joint determination of cigarette demand and price as well as because of unobserved heterogeneity across regions. This problem is resolved by calculating prices as municipality<sup>4</sup> averages and controlling for an extensive set of control variables and region fixed effects. Additionally, total household consumption is used as a proxy for household disposable income, as information on income is not consistently available in all the countries.

As the models are estimated separately and independently, the total price and income elasticity is calculated as the corrected sum of the prevalence and the conditional demand (intensity) elasticity, that is, (the method for each component and the aggregation correction is presented in more detail below).

Aside from prices (that is, the average municipality unit value) and income (that is, total household consumption), the models include a set of covariates, consisting of household characteristics (share of men and adults in the household, maximum or mean level of education and activity of the household members), region and settlement fixed effects and variables representing institutional changes relevant to cigarette consumption. Next, the models estimating the prevalence and then the intensity elasticity of cigarette use are presented.

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<sup>2</sup> Belotti, F., Partha D., Manning W. G., and Norton E., C. (2015): "Twopm: Two-Part Models." *Stata Journal* 15, no. 1: 3–20.

<sup>3</sup> World Health Organization. (2017): *WHO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies*. World Health Organization.

<sup>4</sup> A primary sampling unit is used if the municipality identifier is not available. This applies to prevalence and GLM models, while the Deaton model initially uses unit values as a dependent variable in the first stage equation. In the second stage unit values are used to purge out household characteristics. These are then also aggregated to the municipality or primary sampling unit level.

### 2.1.1 Estimation of the prevalence elasticity

The first part of the model analyzes whether the price of tobacco impacts the decision of a household to smoke, conditional on the set of independent variables. This decision is typically modeled by using the binary choice model. The nature of the dependent variable is the main difference between a binary choice and the classical linear regression model. Instead of modeling a continuous variable in the binary choice models, the probability that the dependent variable  $y_i$  takes value one, which represents the households with positive cigarette expenditure/consumption, versus value zero, which represents the households with zero consumption, is modeled. Consequently, instead of a linear combination of independent variables, a (nonlinear) function of that linear combination is used to explain the probability that a household has positive tobacco expenditures. The most commonly used functions are probit and logit, and in this case, a logit specification is used.

More formally, the following model is estimated:

$$Y = P(y_i > 0) = f(\beta_1 p_i + \beta_2 i_i + \Gamma' X) \quad (2)$$

where  $y_i$  is cigarette consumption of the household  $i$ .  $Y$  is an indicator variable taking value 1 if household consumption is positive;  $p_i$  and  $i_i$  are prices and total household consumption, respectively.  $X$  represents the vector of covariates used in the analysis. After the estimation model is defined, a maximum likelihood procedure is used to fit the coefficients to the logit model.

The logit model assumes that the linear combination of the independent variables  $z = \beta_1 p_i + \beta_2 i_i + \Gamma' X$  is related to the dependent variable via the logit function  $f(z) = e^z / (1 + e^z)$ . Coefficients  $\beta_1$  and  $\beta_2$ , as well as the vector of the coefficients  $\Gamma$ , do not represent the marginal effects and have no clear interpretation. For binary choice models, the marginal effects are not constant, but are a function of all independent variables in the model, as the first derivative of the function is also a function of the probability density. The probability density is a function of the linear combination of all independent variables in the model. Therefore, the marginal effects of the price are calculated as

$$ME_p = \Delta P(y_i > 0) / \Delta p_i = f(z) * \beta_1 \quad (3)$$

and is interpreted as the increase in the likelihood that the household has positive cigarette expenditures for a unit increase in price. The marginal effects for the other variables in the model are analogously calculated; the first derivative is taken with respect to the variable of interest. As before, the derivative is a function of the linear combination of all independent variables in the model<sup>5</sup>.

Finally, the price elasticity of cigarette prevalence is calculated as

$$\xi_{p1} = ME_p(\bar{p} / \bar{Y}) \quad (4)$$

where  $\bar{p}$ , and  $\bar{Y}$  are the average price and prevalence, respectively. The interpretation of the elasticity is that if the prices increase by 1 percent then the probability of positive cigarette

<sup>5</sup> Green, W. H. (2008): Handbook of Econometrics. *Applied Econometrics*, 2, 413-556.



consumption at the household level increases by  $\xi_{p1}$  percent. The interpretation of these effects is, at the level of average prices and the average level of all the variables in the model. The income (that is, total household consumption) elasticity is calculated in a similar fashion.

For a more intuitive understanding of the model results, marginal effects expressed in terms of the percentage point change in prevalence resulting from a percentage change in prices are also calculated. This indicator is calculated as

$$\xi_{p1,pp} = ME_p * \bar{p} \quad (5)$$

The interpretation of the indicator is as follows: for a 1 percent increase in price, the probability that the household will have positive cigarette consumption will increase by  $\xi_{p1,pp}$  percentage points.

### 2.1.2 Estimation of the conditional demand (intensity) elasticity

For the estimation of conditional demand (intensity) elasticity the Deaton demand model<sup>6</sup> is used, with the GLM as a robustness check. Deaton is the preferred model because it relies on Deaton's consumer theory, and also provides a built-in identification strategy and controls for so-called quality shading and measurement error. These characteristics of the Deaton model make the estimates more robust and precise than the GLM estimates.

#### Deaton model

The Deaton demand model is a consumer behavior model in which total expenditure on goods is defined as a product of quantity, quality, and prices. Therefore, the household utility function is augmented as it includes quality of the good. Given its definition as the ratio between the total expenditure and the quantity purchased, the unit value represents the product of quality and price<sup>7</sup>. As the model assumes that all households within a cluster (typically a small territory unit, such as municipality or village) face the same market price, within-cluster variations in purchases depend only on total household expenditure and characteristics that reflect the variation in quality, while cross-cluster variations in purchase are due to genuine price variations, among other factors.

The starting point of the Deaton model is comprised of two equations:<sup>8</sup>

$$w_{hc} = \alpha^0 + \beta^0 \ln x_{hc} + \gamma^0 \cdot z_{hc} + \theta \ln p_c + (f_c + u_{ch}^0) \quad (6)$$

$$\ln v_{hc} = \alpha^1 + \beta^1 \ln x_{hc} + \gamma^1 \cdot z_{hc} + \psi \ln p_c + u_{hc}^1 \quad (7)$$

<sup>6</sup> Deaton, A. (1988): Quality, quantity, and spatial variation of price. *American Economic Review*, 78 (3), 418–430.

<sup>7</sup> John, R. M. (2008): Price elasticity estimates for tobacco products in India. *Health Policy and Planning*; 23(3), 200-209.

<sup>8</sup> Deaton, A. (1997): *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Johns Hopkins University Press, Baltimore.

where indices  $h$  and  $c$  represent households and clusters, respectively. The left hand-side variables in equations (8) and (9) are  $w_{hc}$  – share of the household budget spent on cigarettes (in percentages) and the natural logarithm of  $v_{hc}$  – cigarette unit values. On the right hand-side of both equations, there is  $x_{hc}$  – total expenditures of the household  $h$  in cluster  $c$ ,  $z_{hc}$  – other household characteristics,  $p_c$  – price of the cigarettes in cluster  $c$ , while  $u_{ch}^0$  and  $u_{hc}^1$  represent the error term.

Finally, in equation (1)  $f_c$  are the cluster level effects on the budget share, which are assumed to be uncorrelated with the price effect on the budget share.<sup>9</sup> Since the prices are not observed, the parameters  $\theta$  and  $\psi$  cannot be directly estimated from equations (8) and (9). However, the assumption that market prices do not vary within the cluster (hence the absence of the index  $h$  next to prices) enables consistent estimates of the remaining parameters. Therefore, the usage of the cluster deviation-from-the-mean approach cancels the effect of prices from the equations. We estimate the parameters by including cluster-fixed effects (dummy variables for each cluster) in the regression, which yields identical estimates as deviation-from-the-mean approach.<sup>10</sup>

In the unit value equation (equation 9), coefficient  $\beta^1$  represents the expenditure elasticity, while  $\psi$  represents the price elasticity in unit values. When cigarette prices change, assuming a constant budget, households can either decrease their cigarette consumption or switch to a less expensive brand to keep their consumption at the same level. The latter is referred to as quality shading. If there is no quality shading, the value of  $\psi$  would be equal to one (as the change of the unit value would correspond to change of the price) and  $\beta^1$  would be approximately equal to zero. On the other hand, in the presence of quality shading,  $\psi$  will be less than one (unit value change will be slower than the change of the price) and  $\beta^1$  would be approximately equal to zero.

The second stage uses the estimates from the first stage to remove the effects of total household expenditure, and other household characteristics from the budget shares and the unit values. Variables constructed in this way are then used to create cluster averages of budget shares and unit values, which in accordance with equations (8) and (9) can now be written as

$$y_c^0 = \alpha^0 + \theta \ln p_c + f_c + u_c^0 \quad (8)$$

$$y_c^1 = \alpha^1 + \psi \ln p_c + u_c^1 \quad (9)$$

The estimation of the parameter  $\theta$ , which represents the price semi-elasticity is not feasible since the price is not directly observed. However, Deaton's model uses the presence of price in both equations to establish a relationship between budget shares and unit values. The

<sup>9</sup> John, R. M. (2008): Price elasticity estimates for tobacco products in India. *Health Policy and Planning*; 23(3), 200-209.

<sup>10</sup> Frisch, R., and F. V. Waugh. (1933): Partial time regression as compared with individual trends. *Econometrica* Vol. 1, No. 4, 387-401.

result is parameter  $\phi$ , a hybrid of price and quality elasticity. Deaton proves that  $\phi = \psi^{-1}\theta$ .<sup>11</sup>

In the third stage, the weak separability assumption is introduced. Given the budget share is defined as the product of the quantity of cigarettes and unit value divided by total expenditures, parameter  $\theta$  can be estimated as:

$$\hat{\theta} = \hat{\phi} / [1 + (w - \hat{\phi}) \frac{\hat{\beta}^1}{\hat{\beta}^0 + w(1 - \hat{\beta}^1)}] \quad (10)$$

where  $\hat{\beta}^1$  and  $\hat{\beta}^0$  are coefficients estimated in equations (8) and (9), while  $w$  is the average value of the budget share. The value of  $\hat{\psi}$  is then equal to  $\hat{\phi}^{-1}\hat{\theta}$ . From there, price elasticity of demand can be estimated as:

$$\hat{\epsilon}_p = \left(\frac{\hat{\theta}}{w}\right) - \hat{\psi} \quad (11)$$

Similarly, since equation (8) has budget shares instead of the logarithm of quantity, parameter  $\beta^0$  does not estimate the expenditure elasticity. Instead, the total elasticity of expenditure can be estimated as:

$$\hat{\epsilon}_i = 1 - \hat{\beta}^1 + \left(\frac{\hat{\beta}^0}{w}\right) \quad (12)$$

Following John<sup>12</sup> symmetry restrictions are imposed to increase the precision of the parameter estimates. Furthermore, the system incorporates a composite commodity variable that accounts for all other purchased goods. Due to the calculation procedure, standard errors of price elasticity cannot be taken directly from the regression analyses. Instead, the standard errors of the estimated price elasticity are calculated by using the bootstrapping procedure with 1000 replications.

### Estimation of the conditional demand (intensity) elasticity via GLM

For the households that have positive cigarette expenditures, the number of cigarette packs smoked per month is modeled as a linear function of the independent variables. Therefore, the model is estimated as follows:

$$E(y_i | y_i > 0) = \alpha_1 p_i + \alpha_2 i_i + \theta' X \quad (13)$$

where, as before,  $y_i$  is cigarette consumption of household  $i$ ,  $p_i$  and  $i_i$  are prices and total household consumption, respectively.  $X$  represents the vector of other covariates used in the analysis. The interpretation of the coefficients  $\alpha_1$ ,  $\alpha_2$  and the coefficients vector  $\theta$  is straightforward. They represent the marginal effects of the independent variables. The model is typically estimated via ordinary least squares (OLS) or GLM. The dependent variable is generally represented in the log form as it helps to stabilize non-constant error variance (that is, heteroscedasticity). However, it is necessary to re-transform the coefficients to in-

<sup>11</sup> Deaton, A. (1997): *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Johns Hopkins University Press, Baltimore.

<sup>12</sup> John, R. M. (2008): Price elasticity estimates for tobacco products in India. *Health Policy and Planning*; 23(3), 200-209.

interpret them as marginal effects. The downside to this method is that during the re-transformation, prediction bias may be introduced into the conditional demand.

Manning and Mullahy propose that the second part of the model is estimated via GLM, which does not require the assumption of homoscedasticity or normality.<sup>13</sup> GLM is estimated by the maximum likelihood method. GLM estimates the following model:

$$g\{E(y_i | y_i > 0)\} = \alpha_1 p_i + \alpha_2 i_i + \theta' X, y \sim F \quad (14)$$

where  $g\{\cdot\}$  is the so-called “link function”. The link function describes the relationship that the dependent variable and the linear combination of the predictors have. The type of link function that should be used in GLM is tested via the Box-Cox test.<sup>14</sup> Since the GLM does not assume a constant variance, within the model a function  $F$  is defined as the distributional family that is used to describe the relationship between the variance and mean. When the link function is determined, the Modified Park test is used to find the best approximation of the dependent variable variance.

A standard practice in health economics is to use GLM with gamma family and a log link function. This combination has been proposed to be a more robust alternative to a semi-log regression specification.<sup>15</sup> The difference between the OLS and GLM methods is that the OLS estimator estimates  $E[\ln y | x]$ . Once obtained, the OLS coefficients require retransformation. The GLM estimator estimates  $\ln[E(y|x)]$ , and therefore estimates the marginal effect directly, thereby circumventing the prediction bias issue present in the OLS method. The GLM estimator is consistent even if the variance distribution is not properly defined and does not assume homoscedastic errors. After the model estimation, we calculate the conditional (intensity) elasticity of cigarettes quantity demanded as

$$\xi_{p2} = ME_p(\bar{p}/\bar{y}) \quad (15)$$

where  $\bar{p}$ , and  $\bar{y}$  are the average price and quantity of cigarettes consumed by households with positive consumption respectively. The interpretation of conditional demand elasticity is that if the price increases by 1 percent, cigarette consumption would decrease by  $\xi_{p2}$  percents, assuming that the smoking participation decision does not depend on the price. Income (that is, total household consumption) elasticity is calculated in a similar way.

### 2.1.3 Estimation of the total demand elasticity

In previous chapters, the methodology of the estimation of the prevalence and the conditional demand (intensity) elasticity was explained. Although the literature suggests that these two decisions can be modelled independently<sup>15</sup>, total elasticity cannot be calculated as simple sum of the two elasticities. Instead, this sum needs to be corrected for the fact that a change in the smoking prevalence can attenuate or enlarge the effect of the conditional de-

<sup>13</sup> Manning, W. G., and J. Mullahy. (2001) “Estimating Log Models: To Transform or Not to Transform?” *Journal of Health Economics* 20, no. 4: 461–494.

<sup>14</sup> Box, G. E., & Cox, D. R. (1964). An analysis of transformations. *Journal of the Royal Statistical Society: Series B (Methodological)*, 26(2), 211–243.

<sup>15</sup> Manning, W. G., Basu A., and Mullahy J. (2005): “Generalized Modeling Approaches to Risk Adjustment of Skewed Outcomes Data.” *Journal of Health Economics* 24, no. 3: 465–88

mand (intensity) elasticity. In order to make this more clear, an example is provided with the formula that converts the two elasticities into total elasticity.

Assume that the total population of country XYZ is 10 million people, that that country has a prevalence rate of 40 percent, and that conditional average consumption per person is 25 cigarettes per day (including only those people who smoke). This means that about 4 million people smoke, and total consumption amounts to 100 million cigarettes per day. This situation is presented in table 2.2. column baseline.

Also assume that the prevalence price elasticity in a country is -0.3, while the conditional demand (intensity) elasticity is -0.5. This means that if the prices increase by 1 percent, the prevalence would be lower by 0.3 percent (that is, to 39.88 percent), while the consumption per person would be lower by 0.5 percent (that is, to 24.875 cigarettes per day). This decrease the number of people smoking to 3.988 million (that is, by 0.3 percent), but the total consumption calculated as the product of new prevalence and consumption would decrease by -0.7985 percent, which is less than a simple sum of two elasticities of 0.8 percent. Therefore, due to the prevalence change, a total change in consumption will not be a simple sum of the two elasticities, so the change in prevalence should be corrected for when adding up the change in consumption.

Table 2.2: Hypothetical example for the calculation of the total demand elasticity

		Baseline	Price increases by 1%	% change
<b>Total population</b>	1	10,000,000	10,000,000	
<b>Prevalence</b>	2	40.0%	39.88%	-0.30%
<b>Consumption per person (in cigarettes)</b>	3	25	24.875	-0.50%
<b>Number of people smoking</b>	4=1*2	4,000,000	3,988,000	-0.30%
<b>Total consumption</b>	5=4*3	100,000,000	99,201,500	<b>-0.7985%</b>

More formally the total elasticity can be calculated according to the following formula:

$$\xi_p = \xi_{p1} + (1 + \xi_{p1}) * \xi_{p2} \quad (16)$$

Where  $\xi_{p1}$  represents the prevalence elasticity,  $\xi_{p2}$  represents the conditional demand (intensity) elasticity and  $\xi_p$  represents the total elasticity, if all the elasticities are expressed as percentages.

## 2.2 Estimation of elasticities at different parts of the income distribution

As mentioned in the introduction, the second part of the analyses estimates the price and income elasticity of demand by income group. Income groups are constructed based on total household consumption (a proxy for income) per capita. Given the relatively small sample size in some countries, three income groups are created: low-income, middle-income, and

high-income. As in all the countries, several waves of HBS is used, and the division into three income groups is done for each year, so that an equal number of households belongs to each of the three groups in all years.

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, followed by use of the above formula for total elasticity to calculate total elasticity by income group.<sup>16</sup>

### 2.3 Simulation of price and excise increase on consumption and government revenue

Finally, within topic 3, the estimated price and income elasticities are used to simulate the impact of price and excise tax increase on consumption and government revenue. As mentioned in the introduction, the total price and income elasticities are calculated as a corrected sum of prevalence elasticity and intensity (that is, conditional demand) elasticity from the Deaton model. In both cases, the elasticities are used when applying the models to the overall sample.

The starting point of the analysis is cigarette consumption, which is obtained from the administrative data on cigarette packs for the year for which the latest HBS is available (a more detailed data source description will be given in each country chapter). In order to account for the impact of an increase in income on consumption, the following inputs are used: total HBS real expenditure growth (a proxy for income growth) based on the ratio between the total expenditure in the year  $t+1$  and the total expenditure in the year  $t$ , where  $t$  is the latest year when HBS is available<sup>17</sup>. Three scenarios are simulated, presenting the estimated impact of three alternative price increases: of 10, 25, and 50 percent.

In order to calculate a change in quantity demanded (or consumption), the following formula is applied:

$$D_{t+1} = D_t(1 + \xi_p * \Delta p[\%] + \xi_i * \Delta i[\%]) \quad (17)$$

where  $D_{t+1}$  is the new demand,  $D_t$  is the demand in year  $t$ ,  $\xi_p$  and  $\xi_i$  are price and income elasticities, while  $\Delta p[\%]$  and  $\Delta i[\%]$  represent the percentage increases of real prices (which are set arbitrarily at 10, 25 and 50 percent) and real income (fixed, calculated as a ratio between the total consumption in the year  $t+1$  and the total consumption in the year  $t$ , where  $t$  is the latest year when HBS is available).

The calculation of a change in government revenue stemming from taxes on cigarettes is done in two steps. In the first step, for year  $t$ , the excise and VAT is calculated for a single cigarette pack according to the current taxation rules in each country and this rule is applied to the weighted average price of cigarettes in the country in year  $t$ . The change in price that

<sup>16</sup> The prevalence model, as well as the GLM for estimation of the conditional demand (intensity), uses the price proxy calculated based on the unit values from the overall sample. Therefore, all households, regardless of the income groups they belong to, are “facing” the same price.

<sup>17</sup> Although the data from the year  $t+1$  are not available in all the countries this information can be found in the statistical reports.

would occur in year  $t+1$  is simulated, and the impact that this would have on excise and VAT in each country for year  $t+1$  is calculated. Where the country has a specific excise rate, the increase in the specific excise from the year  $t$  to year  $t+1$  will be at the same rate as the increase of the price (that is, by 10, 25 and 50 percent in the three simulation scenarios).

In the second step, for the year  $t$ , the total excise and VAT is calculated as a product of the excises and VAT charged on the single pack (price at the average weighted price level) according to the prices and taxation rules from the year  $t$ , and total demand from the administrative data from the year  $t$ . For the year  $t+1$ , similarly, the total excise and VAT is calculated as a product of the excises and VAT charged on the single pack according to the increased prices and taxation rules from the year  $t+1$ , and the simulated demand calculated in the equation (15). Data is presented in euros so that they are more easily comparable across six countries in the SEE region.

### 2.3.1 Simulation of the impact of price on demand and expenditures of income groups

Finally, the impact of a price change on cigarette demand and expenditure on cigarettes for each of the income groups is calculated. The simulation strategy is similar to the one for the overall sample and based on the estimated elasticities (the methodology for the estimation of the elasticities is explained in section 2.2.). The starting point of the analysis is the cigarette consumption in each of the income groups. As the administrative data are not available for each of the income groups, HBS data for the last year available is used to calculate the share of cigarette consumption of each income group in total country consumption. These shares are multiplied by the total consumption from administrative data to derive the estimated consumption of each of the income groups.

The total expenditure growth of each of the income groups is calculated as an increase in the total expenditure between the last two years of the HBS data available (2016 and 2017). The scenario in which prices increase by 25 percent is simulated as a middle increase among the previous solutions. In order to arrive at the demand change for each of the income groups, equation (17) and the data for each of the income group is used. The change in expenditure for each income group is calculated as the difference in products of weighted average price and the demand for each income group in year  $t$  and year  $t+1$  in which the prices increase by 25 percent.

## 8 Serbia

**Increasing excises and prices of cigarettes in Serbia would result in lower cigarette consumption.** The price elasticity of demand for cigarettes is estimated at -0.659, indicating that if cigarette prices increase by 10 percent the demand for cigarettes would decrease by 6.6 percent on average. This decrease would stem from both a decrease in smoking prevalence (by 2.6 percent) and smoking intensity (by 4.5 percent). **A decrease in consumption of cigarettes would lower the harmful health effects of cigarettes, such as death and disease.**

**An increase in cigarette excises would result in an increase of government revenue from tobacco taxation.** Simulation results show that if prices were to increase by 10 percent, total government revenue would increase by 9.0 percent despite the decrease in consumption. This is due to the inelastic demand for cigarettes.<sup>47</sup> **Further positive fiscal effects could be expected since the decrease in cigarette consumption would likely lower health expenditures related to harmful effects of cigarettes.**

**The decrease in consumption resulting from the price increase is not the same for all income groups. The decrease would be the highest for low-income households.** A 10 percent price increase, as a result of 17.8 percent increase of specific excise, would lower the demand for cigarettes among low-income households by 5.4 percent, while the decrease for middle- and high-income households would be 2.4 percent and 0.7 percent, respectively.

**If the prices of cigarettes increase, low-income households would decrease their expenditures on cigarettes.** On the contrary, expenditures on cigarettes for middle- and high-income households would increase. Considering these divergent **consumer responses to cigarette price increases, increasing excises would be a pro-poor policy that has the potential to lower inequality in the country.** Lower expenditures on cigarettes for low-income households would likely be coupled with **lower health expenditures related to harmful effects of cigarettes.**

### 8.1 Data and descriptive statistics

In order to estimate the price elasticity of cigarette consumption in Serbia, Household Budget Survey (HBS) data from 2006 to 2017 is used. HBS is an annual survey, which provides detailed information on household consumption, as well as on individual characteristics of the household members. Additionally, survey data contain information on the municipality and region in which the respondents live. In total, there were 62,054 households in the sample.

Table 8.1 presents the data on cigarette use available from HBS. Smoking prevalence, defined as the share of the households that reported positive cigarette expenditures, has significantly decreased over the observed period: from 49.7 percent in 2006 to 34.2 percent in 2017, or by about 30 percent. Moreover, households have decreased their smoking intensi-

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<sup>47</sup> Demand is inelastic when people's consumption of cigarettes does not change as much as the price changes.



ty: the average number of cigarettes smoked in the same period decreased from 39.1 to 27.2 packs per household per month, also by about 30 percent.<sup>48</sup>

At the same time, however, household expenditures on cigarettes increased: the average household expenditure (among the households with positive expenditures) increased from 1,988 RSD in 2006 to 3,241 RSD in 2017 (expressed in 2006 values), or by about 63 percent. As the increase of household expenditure coincided with the lowering of the smoking intensity, this means that real cigarettes prices were growing faster than smoking intensity was declining.

Table 8.1: Cigarette use in Serbia: prevalence, expenditures, number of consumed cigarettes

Year	Smoking prevalence (% of households)	Average number of cigarettes smoked (packs per household) <sup>1</sup>	Average real household expenditure on cigarettes (in RSD) <sup>1 2</sup>	Average real price (in RSD) <sup>1 2 3</sup>
2006	49.7 %	39.1	1,988	51.9
2007	47.9 %	39.2	2,279	58.7
2008	44.1 %	39.0	2,268	58.9
2009	42.0 %	37.9	2,353	62.7
2010	38.8 %	37.0	2,442	65.9
2011	38.4 %	36.2	2,487	68.7
2012	38.0 %	34.3	2,609	75.8
2013	35.1 %	29.6	2,758	93.0
2014	34.4 %	27.7	2,922	104.9
2015	36.3 %	28.9	2,985	103.2
2016	33.7 %	29.1	3,219	110.2
2017	34.2 %	27.2	3,241	117.8

Source: Authors' calculation based on HBS data for Serbia

<sup>1</sup> Based on reported expenditure and quantities of households with positive expenditure on cigarettes.

<sup>2</sup> Variables deflated by CPI to 2006 values.

<sup>3</sup> The average price is proxied by the average unit value, which is ratio of reported household expenditure on cigarettes and purchased quantity.

HBS does not collect data on prices, so this analysis uses a ratio of (real) household expenditure on cigarettes and the quantity of cigarettes smoked to calculate (real) unit values of cigarettes for each household. Average unit values of cigarettes reported by households within one municipality for each year and is used as a proxy for cigarette price.<sup>49</sup> Yearly trends of this variable are presented in the last column of Table 8.1. The average real price

<sup>48</sup> Since only 1.7percent of households in the sample report expenditures on cut tobacco this variable is not included in the analysis. Although there is a likely substitution effect between cigarettes and cut tobacco, the low number of households with positive cut tobacco consumption suggests that cut tobacco expenditures are not likely to impact the results.

<sup>49</sup> For 1,152 households the prices are replaced with regional (NUTS2) yearly averages, as in 733 cases there was only one household within municipality with positive expenditures and in 419 there were no households with no cigarette expenditures within the municipality.

(proxy) of cigarettes increased from about 52 RSD in 2006 to about 118 RSD in 2017 (expressed in 2006 values), indicating that the real price of cigarettes increased by 2.3 times.<sup>50</sup>

Therefore, while the prices of cigarettes more than doubled in real terms over the observed twelve years, during the same period both smoking prevalence and smoking intensity decreased by about 30 percent. The next section discusses the regression analysis described in chapter 2 to analyze the effect of prices on smoking prevalence and intensity while controlling for the impact of other variables.

## 8.2 Estimation of the price and income elasticity

The nature of tobacco consumption as a dependent variable requires that the prevalence and conditional demand elasticity are estimated separately. In what follows, the main results – price and income elasticities are presented, while the full results with specification tests can be found in an online appendix (Appendix F).

### 8.2.1 Prevalence elasticity

According to the estimates from the logit model (model 4, Table F1) the price elasticity of smoking prevalence in Serbia amounts to -0.265. This means that a 10 percent increase in the price of cigarettes decreases smoking prevalence by 2.65 percent. To better explain the meaning of estimated prevalence elasticity, a 10 percent increase in price would reduce current prevalence in absolute terms by 0.9 percentage points from 34.2 percent to 33.3 percent (see model 4, Table F1).

All other things equal, households with higher income (that is, higher total expenditure, which is used as a proxy for income) have higher levels of smoking prevalence. On average, total household expenditure elasticity is 0.609. In other words, a 10 percent higher income results in about 6 percent higher prevalence. In absolute terms, a 10 percent increase in income increases prevalence by about 1.8 percentage points from 34.2 percent to 36.0 percent (see section Table 8.2).

Additionally, the results from the model (Table F1) indicate that prevalence is higher in larger households and in households with higher shares of men and adults. Education, conditional on all other variables, has a non-linear impact: the lowest prevalence is associated with the lowest (incomplete primary) and highest (tertiary) levels of education. Compared to Belgrade, all other regions have higher prevalence. "Pensioner" and "self-employed" households have lower, while "unemployed" households have higher prevalence than "employed" households. Finally, the introduction of the advertisement ban in 2010 has reduced smoking prevalence.

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<sup>50</sup> According to the official Statistics Office of the Republic of Serbia (SORS) data and our calculations, real tobacco Consumer Price Index (CPI) grew by 2.4 times, with similar trends by years, confirming the validity of the price measure that we use in our estimates.

## 8.2.2 Conditional demand (intensity) elasticity

### Deaton model

The estimated value of conditional income elasticity is positive at 0.447. In other words, among the households which consume cigarettes, a 10 percent higher total expenditure is associated with a 4.47 percent higher quantity of cigarettes smoked. On the other hand, results indicate a negative price elasticity of -0.395. In other words, if cigarette prices in Serbia increased by 10 percent, the quantity of cigarettes consumed by those who smoke would decrease by about 4 percent.

### GLM estimate

In order to test the robustness of the results obtained in the Deaton model the conditional income and price elasticity of demand is also estimated using the GLM model.

According to the results (model 4, Table F6), conditional (intensity) elasticity in Serbia is -0.450, which means that, among households that smoke, a 10 percent price increase decreases cigarette consumption by 4.5 percent.

All other things equal, households with higher income smoke more. Significance of the square term indicates that this relation is not linear, but that the effect diminishes with higher levels of income. On average, conditional income elasticity is 0.413 and does not vary significantly across the models. In other words, a 10 percent increase in income leads to an increase in cigarette consumption by about 4.1 percent. In all specifications control variables show expected signs: conditional smoking (intensity) demand is higher in larger households and households with higher shares of men and adults. Education, conditional on all other variables, lowers the smoking conditional intensity, while smokers in Belgrade smoke less than people from other regions. "Pensioner" and "self-employed" households have lower, while "unemployed" households have higher smoking intensity than the "employed" households. Finally, the introduction of the advertisement ban in 2010 has no effect on smoking intensity.

## 8.2.3 Total price and income demand elasticity

Based on the estimates above, total demand elasticity is calculated.<sup>51</sup> Table 8.2 presents two estimates of the total demand elasticity, which differ in the method applied to estimate the conditional demand elasticity. Total price elasticity amounts to -0.659, when the conditional demand is estimated using Deaton method. The same indicator is slightly higher, -0.714, when conditional demand is estimated via GLM. Total income elasticities are also similar for the two approaches: 1.056, when conditional demand is estimated via Deaton model, and 1.024 when conditional demand is estimated via GLM. The fact that the elasticities are similar confirms the robustness of the results.

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<sup>51</sup> As explained in the methodology section, total elasticity is a corrected, rather than a simple sum of the two elasticities. More precisely, the size of the conditional demand elasticity needs to be corrected for the change in the number of smokers which occurs due to the increase/decrease in the prevalence.

Table 8.2: Total demand elasticity (comparison of Deaton and GLM model)

		Conditional demand estimate from Deaton model		Conditional demand estimate from GLM	
<b>Total demand elasticity</b>	price	-0.659		-0.714	
	income	1.058		1.024	
<b>Prevalence elasticity</b>	price	-0.265***	(0.051)	-0.265***	(0.051)
	income	0.609***	(0.020)	0.609***	(0.020)
<b>Conditional intensity elasticity</b>	price	-0.395***	(0.020)	-0.450***	(0.030)
	income	0.447***	(0.011)	0.413***	(0.012)

Source: Authors' calculation based on HBS data

Cluster robust standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Since the Deaton model accounts for the so-called “quality shading” (see Chapter 2), the remaining part of the study uses the Deaton model estimates as the primary result. The results from this model suggest that a 10 percent higher price is associated with the 6.6 percent reduction in demand for cigarettes. Similarly, a household with a 10 percent higher income has a 10.56 percent higher demand for cigarettes.

### 8.3 Price elasticity by income group

This part of the chapter examines trends in cigarette demand over the period 2006-2017 and estimates cigarette price and income elasticities by income group. Three groups of equal size are formed based on the total household expenditure per capita in each year, which is a proxy for household income: low-, middle-, and high-income.

#### 8.3.1 Demand trends by income group

As mentioned previously, smoking prevalence in Serbia decreased significantly between 2006 and 2017, by 15.5 percentage points. Figure 8.1 (left panel) presents prevalence trends for the three income groups and compares them with the average prices<sup>52</sup> for the period. The decrease in prevalence was the sharpest among low-income households, where the decrease was 18.6 percentage points (from 47 to 28.4 percent) (Figure 8.1) The decrease was slightly lower for middle-income households – by 17.5 percentage points (from 53.4 to 35.9 percent), while prevalence decrease of high-income households was below the average, at 10.7 percentage points (from 48.8 to 38.1 percent). Furthermore, in the period of the highest rise of prices (2011-2014), low-income households decreased their prevalence more than the two other income groups, indicating that low-income group prevalence trends might be more related to the price changes.

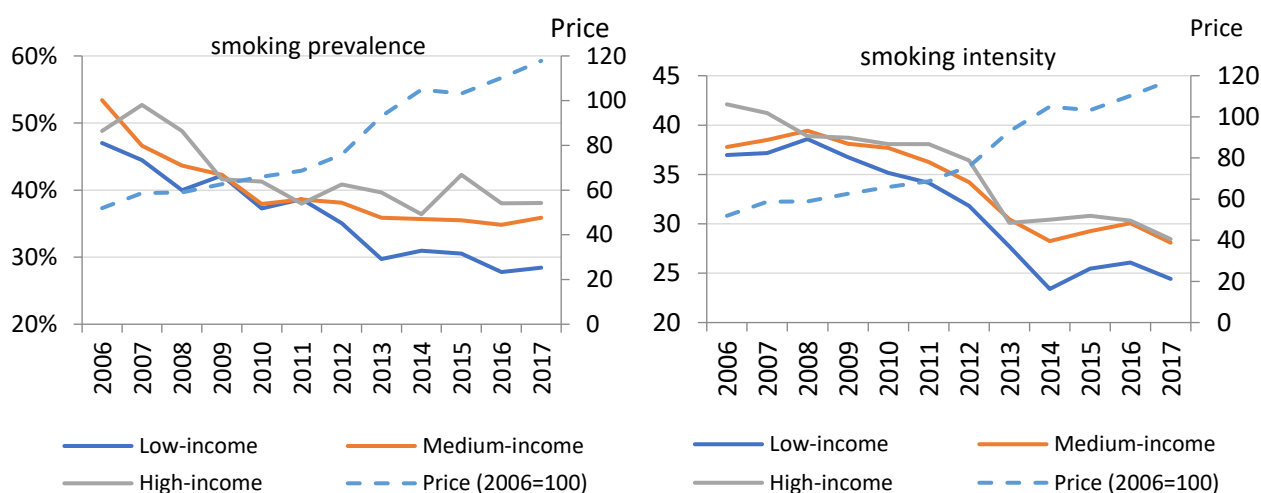
On the other hand, among the households with positive cigarette consumption, between 2006 and 2017, smoking intensity decreased on average by 11.9 packs per month. The decrease was above average in high-income households, by 13.7 packs (from 42.1 to 28.4 packs, or by about 32 percent), and in low-income households, by 12.6 packs (from 37 to 24.4 packs, or by about 34 percent). On the other hand, in middle-income households the decrease was the lowest – 9.7 packs (from 37.8 to 28.1 packs, or by about 26 percent). Simi-

<sup>52</sup> Unit value averages by municipality and year are used as a proxy for prices. See section 2 for more details.

lar to the prevalence trends, Figure 8.1 (right panel) indicates that in the period of the highest rise of the prices (2011-2014), smoking intensity among low-income households decreased more than the two other income groups.

Therefore, in low-income households, the decrease in both smoking prevalence and intensity was higher than the national average. This resulted in unchanged real expenditures on cigarettes for low-income households (including both consuming and non-consuming households) in the period in which real prices of cigarettes more than doubled, while the budget share spent on cigarettes decreased by 0.4 percentage points (decrease from 3.3 to 2.9 percent). On the other hand, in the two other income groups real expenditures increased by about 20 percent, which led to a slight increase in the total budget shares spent on cigarettes by 0.4 percentage points for middle-income households (from 3.0 to 3.4 percent) and by 0.8 percentage points for high-income households (from 2.4 to 3.2 percent).

Figure 8.1: Smoking prevalence and conditional (demand) intensity trends by income group



Source: Authors' calculation based on HBS data

Notes: Smoking prevalence is defined as the share of the households with positive tobacco consumption, while smoking intensity represents the number of cigarette packs a household with positive expenditures on cigarettes smoked per month. Cigarette prices are defined as municipality/year average cigarettes' unit values (ratio between total expenditure and quantity) and expressed in real terms (2006=100).

### 8.3.2 Prevalence elasticity by income group

Table 8.3 shows that the price elasticity of smoking prevalence is the highest for low-income households, estimated at  $-0.565$ , as expected.<sup>53</sup> The price elasticity of high-income households is not statistically significant suggesting that their decision to smoke is not impacted by price, but by other factors. A 10 percent price increase decreases smoking prevalence by 5.6 and 2.6 percent in low-, and middle-income households respectively, while for high-income households price does not affect smoking prevalence.

<sup>53</sup> Table F10 in the Appendix presents the full model.

Table 8.3: Prevalence and conditional demand elasticities by income group

	Low-income households		Middle-income households		High-income households		All households	
<b>Prevalence elasticities (logit model)</b>								
<b>Price</b>	-0.565***	(0.075)	-0.261***	(0.070)	-0.040	(0.066)	-0.265***	(0.050)
<b>Income</b>	0.809***	(0.044)	0.665***	(0.062)	0.401***	(0.031)	0.609***	(0.020)
<b>Conditional demand (intensity) elasticity (Deaton's model)</b>								
<b>Price</b>	-0.514***	(0.067)	-0.371***	(0.065)	-0.220***	(0.041)	-0.395***	(0.053)
<b>Income</b>	0.550***	(0.037)	0.598***	(0.065)	0.338***	(0.025)	0.447***	(0.011)

Source: Authors' calculation based on HBS data

Notes: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The analysis further indicates that in all income groups, higher income increases smoking prevalence, in other words, all three income groups have positive income elasticities. Similar to price elasticity, income elasticity is the highest for low-income households, at 0.809, slightly lower in the middle-income group 0.665, and the lowest in the high-income group, at 0.401. This means that having a 10 percent higher income is associated with 8.1, 6.6, and 4.0 percent higher smoking prevalence by for low-, middle-, and high-income households, respectively

### 8.3.3 Conditional demand (intensity) elasticity by income group

The conditional demand elasticity in each income group is estimated using the Deaton model. For the overall sample, price elasticity is estimated at -0.395, with an income elasticity of 0.447. Estimates by income group are as follows:

Price elasticity is negative and estimated at -0.514, -0.371, and -0.220 for low-, middle- and high-income households, respectively.<sup>54</sup> In other words, if cigarette prices in Serbia increased by 10 percent, the quantity demanded for cigarettes among smoking households will decrease by about 5.1, 3.7, and 2.2 percent for low-, middle-, and high-income groups, respectively.

Income elasticity is positive and estimated at 0.550, 0.598, and 0.338, for low-, middle- and high-income households, respectively. In other words, a 10 percent higher income is associated with 5.5, 6.0, and 3.4 percent higher quantity of cigarettes smoked in low-, middle-, and high-income households, respectively.

<sup>54</sup> Price elasticities from the GLM suggest slightly higher values at -0.605, -0.441, and -0.348 for low-, middle-, and high-income households, respectively. Higher values from GLM model are expected as, unlike the Deaton model it does not correct for the quality shading, which results in an upward bias of the coefficients.

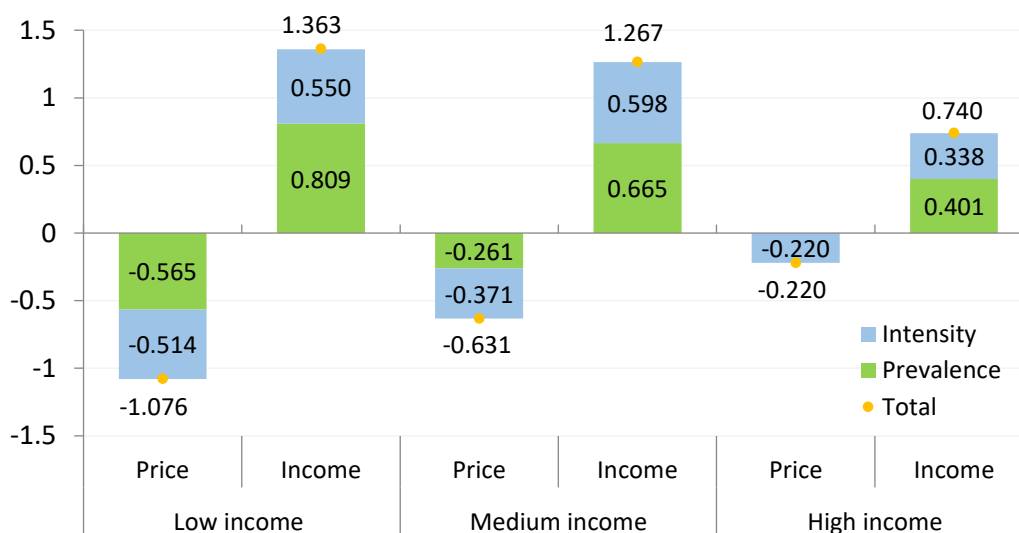
### 8.3.4 Total price and income elasticity by income group

Based on the estimates of prevalence and conditional demand elasticity from the previous sections, total demand elasticity is calculated and presented below by income group in Figure 8.2.<sup>55</sup>

Total price elasticity is the highest for low-income households at -1.076, which means that a 10 percent price increase leads to a decrease in consumption by 10.8 percent. In the middle-income households, total elasticity is almost two times lower at -0.631, with more of the effect attributable to a decrease in smoking intensity than the lowering of prevalence. Finally, elasticity is the lowest in the high-income group at -0.220 and the effect is entirely attributable to a decrease of smoking intensity, as prices have no significant effect on prevalence.

Total income elasticities in all the groups are higher than the total price elasticities and estimated at 1.363; 1.267 and 0.740 for low-, middle-, and high-income households, respectively.

Figure 8.2: Total elasticity by income group



Source: Authors' calculation based on the estimated elasticities (Table 8.3)

## 8.4 Impact of price increases on consumption and government revenue

This section discusses the economic implications of the estimated price and income elasticities of cigarette consumption in Serbia. The obtained elasticities are used to simulate the

<sup>55</sup> As explained in the methodology section, total elasticity is a corrected, rather than a simple sum of the two elasticities. More precisely, the size of the conditional demand elasticity needs to be corrected for the change in the number of smokers which occurs due to the increase/decrease in the prevalence.

effect that a price increase would have on cigarette consumption and total government revenue from taxes on cigarettes, including both excises and value-added tax (VAT). According to the Ministry of Finance, Tobacco Administration Department, total cigarette consumption in Serbia in 2017 was 671.4 million packs while the weighted average price of cigarettes was €1.87 (that is, 226.96 RSD). According to the taxation rules, which include specific excise of €0.53 per pack (64.75 RSD), ad valorem excise of €0.62 per pack (in other words, 33 percent of the retail price), and VAT of €0.31 per pack (20 percent of the pre-VAT price) per pack, total tax paid on a pack of cigarettes in Serbia amounts to €1.46, and it represents about 78.8 percent of the total retail price. Estimated total government revenue from cigarette consumption in 2017 was about 982 million euros (or 6.9 percent of the total government tax revenues).

Total price and income elasticities are estimated at -0.659 and 1.058 (Table 8.2), respectively. Assumed real growth in household consumption in 2018 is 3.0 percent.<sup>56</sup> Detailed below are simulations of a price increase of 10 percent, 25 percent, and 50 percent on cigarette consumption and government revenues from cigarette taxation in 2018. Such growth in retail prices could be achieved by an increase of excise taxes by 17.7 percent, 44.4 percent, and 88.8 percent, respectively, while holding ad valorem tax and VAT rates at the same levels as they are. In the government revenue simulations, it is assumed that producers are not going to change their net-of-tax prices.

The effects on tobacco consumption are calculated as follows:

$$D_{t+1} = D_t * (1 + E_p * \%p \text{ change} + E_i * \%i \text{ change})$$

where  $D_{t+1}$  is the new demand,  $D_t$  is the demand in year  $t$ ,  $E_p$  and  $E_i$  are price and income elasticities, while  $\%p$  and  $\%i$  change are the percentage increases in price and income, respectively.

The change in consumption and government revenues where prices increase by 10, 25, and 50 percent are shown in Table 8.4.

Table 8.4: Impact of price increases on consumption and government revenues

		Price	Consumption		Revenue	
		(Euros)	(Million packs)	(% change)	(Million euros)	(% change)
<b>Baseline</b>		1.87	671.4	0	982.0	0
<b>Scenario</b>	Price increase	New price				
	10%	2.06	648.4	-3.4%	1,070	8.9%
	25%	2.34	582.1	-13.3%	1,124	14.4%
	50%	2.81	471.5	-29.8%	1,130	15.1%

Source: Authors' calculation based on Ministry of finance data and estimated elasticities

<sup>56</sup> According to SORS, total household consumption grew in 2018 by 3.0 percent (<https://publikacije.stat.gov.rs/G2019/PdfE/G20191267.pdf>)



In addition to its potential to generate additional revenues, a cigarette price increase could potentially lead to significant health and economic benefits through reduced consumption. Numerous evidence shows that higher prices of cigarettes have a beneficial impact on health and development.<sup>57</sup>

## 8.5 Impact of price increases on consumption and expenditures by income group

A more nuanced estimate of the impact of price increases on consumption and revenues is obtained by estimating changes by income group, as they respond differently. First, total consumption of cigarettes is split by income group by applying the shares of total consumption calculated from HBS 2017 data. As data on real growth in household consumption by income group is not available, the estimated 2018 growth rate of 3.0 percent is adjusted for each income group based on the real growth in private consumption by income group between 2016 and 2017 obtained from HBS data. For the low-, middle-, and high-income group, estimated growth rates are 3.9, 3.1, and 2.0 percent, respectively. Assuming a 25 percent price increase, achieved by an 44.4 percent increase of excise tax, estimated price and income elasticities by income group (Figure 2) are used to estimate the change in cigarette consumption and tax revenues in 2018.

Table 8.5 presents the results of the simulation. As expected, the low-income group would experience the largest reduction in consumption (21.6 percent) and a reduction in spending on cigarettes (2.0 percent), while the government revenue collected from this group would increase by (3.5 percent). The reduction in consumption in the middle- and high-income groups would be significantly lower, and their spending on cigarettes would increase. This result supports the argument that an increase in tobacco taxes and prices would increase the progressivity of the tobacco excise tax system in Serbia, and that the poor would benefit the most. The overall impact of a 25 percent price increase would be a reduction in consumption of 11 percent and additional government revenue from tobacco taxation of 17.4 percent.

Table 8.5: Impact of price increase on consumption and expenditures by income group

Income group	Consumption			Government revenue			Spending on tobacco		
	Base-line <sup>1</sup>	Scenario <sup>1</sup>	Change	Base-line <sup>2</sup>	Scenario <sup>2</sup>	Change	Base-line <sup>2</sup>	Scenario <sup>2</sup>	Change
<b>Low</b>	162.0	127.0	-21.6%	236.3	244.7	3.5%	302.9	296.9	-2.0%
<b>Middle</b>	238.4	210.1	-11.8%	347.7	404.8	16.4%	445.8	491.2	10.2%
<b>High</b>	271.0	260.1	-4.0%	395.3	501.0	26.7%	506.8	608.0	20.0%
<b>Total</b>	671.4	597.3	-11.0%	979.3	1,150.5	17.5%	1,255.4	1,396.1	11.2%

<sup>1</sup> In million packs;

<sup>2</sup> In million euros

Source: Authors' calculation based on Ministry of finance data and estimated elasticities

<sup>57</sup> <https://tobacconomics.org/wp-content/uploads/2018/08/Tobacco-and-SDG-Brief-FINAL.pdf>

## 9 Summary and Conclusions

The results of the research provide a unique comparative analysis for all the countries. This chapter summarizes the results presented in country chapters 3 to 8 and offers conclusions and recommendations based on the collected evidence.

In all the analyses, microdata from HBS was used to estimate the price and income elasticities of cigarettes use. Descriptive data from HBS is presented in tables 9.1-9.3.

*9.1 Average cigarette prices in six SEE countries (€, in 2015 values)*

	ALB	B&H	KSV	MNE	NMK	SRB
<b>2006</b>				0.98		0.78
<b>2007</b>		0.81	1.28	0.95		0.89
<b>2008</b>			1.22	0.95		0.89
<b>2009</b>			1.52	1.07		0.95
<b>2010</b>			1.40	1.13		1.00
<b>2011</b>		1.21	1.40	1.34		1.04
<b>2012</b>			1.56	1.52		1.15
<b>2013</b>			1.51	1.64		1.41
<b>2014</b>	1.63		1.52	1.74	1.50	1.59
<b>2015</b>	1.65	1.87	1.66	1.70	1.65	1.56
<b>2016</b>	1.68		1.77		1.86	1.66
<b>2017</b>	1.71		1.89	1.68		1.78

The price of cigarettes, as a proxy of unit values, calculated from HBS is similar in all countries. The cost is deflated to 2015 values since that is the only year for which data is available from all countries. Even though the prices were significantly different in the past, recent data show that they have converged to a large extent. This leads to the conclusion that the market of six countries could be observed as one single market.

*9.2 Smoking prevalence in six SEE countries (in %)*

	ALB	B&H	KSV	MNE	NMK	SRB
<b>2006</b>				52.4		49.7
<b>2007</b>		57.4	48.2	52.6		47.9
<b>2008</b>			47.8	56.2		44.1
<b>2009</b>			41.1	50.4		42.0
<b>2010</b>			52.1	44.1		38.8
<b>2011</b>		48.4	50.9	44.2		38.4
<b>2012</b>			53.4	42.5		38.0
<b>2013</b>			49.0	42.1		35.1
<b>2014</b>	38.7		49.7	44.1		34.4
<b>2015</b>	31.6	33.8	46.9	40.2	40.5	36.3
<b>2016</b>	31.3		45.2		39.7	33.7
<b>2017</b>	31.7		46.3	36.5	39.5	34.2

While the average cigarette price is similar across countries, smoking prevalence<sup>58</sup> varies between 31 and over 56 percent over the 12 year period. However, it is important to note that, as reported in previous studies<sup>59</sup> in Albania, B&H, and Kosovo, there is a large disproportion in prevalence among the male and female population, while in other countries the rates are similar for both genders. It is also noticeable that prevalence rates do not follow the same trend in the region. The largest decrease is registered in B&H, Serbia, and Montenegro, while in Kosovo and North Macedonia there is practically no change observed. The decrease in prevalence rates is stagnating in the latest reported years.

*9.3 Average monthly household consumption of cigarettes in six SEE countries (number of packs)*

	ALB	B&H	KSV	MNE	NMK	SRB
<b>2006</b>				34.7		39.1
<b>2007</b>		37.4	41.3	34.5		39.2
<b>2008</b>			40.2	38.4		39.0
<b>2009</b>			43.1	34.2		37.9
<b>2010</b>			40.0	32.4		37.0
<b>2011</b>		32.3	40.6	31.9		36.2
<b>2012</b>			43.2	29.4		34.3
<b>2013</b>			41.6	27.6		29.6
<b>2014</b>	17.4		42.4	26.5		27.7
<b>2015</b>	19.0	22.9	42.0	28.8	30.5	28.9
<b>2016</b>	18.4		40.8		29.1	29.1
<b>2017</b>	19.5		41.9	33.4	28.2	27.2

The change in smoking intensity also varies by country. While in Albania, Kosovo, and Montenegro there has been no change in average consumption, in B&H, Serbia, and North Macedonia there is a stable decreasing trend.

The differences observed in descriptive statistics have a significant impact on the research outcomes, namely estimation of prevalence and intensity price elasticity of demand for cigarettes; estimation of price elasticity of demand by income group; and simulation of the impact of an increase in tobacco excise and price on consumption and government budget.

*Table 9.4: Price elasticities of cigarette consumption in six SEE countries*

	ALB	B&H	KSV	MNE	NMK	SRB
<b>Prevalence</b>	-0.165	-0.563	0.000	-0.636	-0.214	-0.265
<b>Intensity</b>	-0.267	-0.458	-0.387	-0.432	-0.232	-0.395
<b>Total</b>	-0.432	-1.018	-0.387	-1.065	-0.446	-0.659

<sup>58</sup> Smoking prevalence in this study is expressed as a share of households that report positive consumption of cigarettes in total number of households.

<sup>59</sup> <http://www.tobaccotaxation.org/research.php?cID=26&lng=srb>

**Increasing excises and prices of cigarettes will result in lower cigarette consumption in all countries.** Total price elasticity varies from -0.387 in Kosovo to -1.065 in Montenegro, indicating that if the cigarette prices increase by 10 percent the demand for cigarettes would decrease by 3.8-10.6 percent. This decrease would stem from both a decrease in the smoking prevalence and smoking intensity. More details about price elasticities are presented in Table 9.4.

Distribution of total price elasticity between prevalence and intensity is not even among the countries. Consumers in Albania, Kosovo and Serbia react more intensively to change in price by reducing the number of cigarettes smoked. In B&H and in Montenegro there is a stronger reaction in terms of quitting smoking. At the same time in North Macedonia, there is even distribution of the two elasticities. It is important to note that value of prevalence intensity for Kosovo equals zero due to not statistically significant causality between the price and prevalence rates.

Table 9.5: Income elasticities of cigarette consumption in six SEE countries

	ALB	B&H	KSV	MNE	NMK	SRB
<b>Prevalence</b>	0.781	0.374	0.212	0.308	0.411	0.609
<b>Intensity</b>	0.329	0.426	0.568	0.286	0.465	0.447
<b>Total</b>	1.113	0.802	0.779	0.595	0.874	1.058

**Increasing income would result in higher cigarette consumption in all countries.** Total income elasticity varies from 0.595 in Montenegro to 1.113 in Albania, indicating that if the income increases by 10 percent the demand for cigarettes would increase between 5.9 and 11.1 percent. This growth would stem from both the growth of smoking prevalence and smoking intensity. More details about income elasticities are presented in Table 9.5.

Distribution of total income elasticity between prevalence and intensity is not even among the countries. Consumers in Kosovo and North Macedonia react more intensively to changes in income by increasing the number of cigarettes smoked. In Albania and in Serbia there is a stronger reaction in smoking initiation. At the same time in B&H and Montenegro, there is even distribution of the two elasticities.

Comparison of the total price and income elasticities shows that in Albania, Kosovo, North Macedonia, and Serbia the values of income elasticities are higher than price elasticities, indicating that in those countries the growth in income could easily erase the impact of increasing prices, especially in Albania. This result indicates that when countries revise excise policies, they should account for the expected growth of income in the country. **Therefore, increasing excises would have an inequality-reducing effect.**

**Total income and prices elasticities are significantly different if compared by income groups.** Prices elasticities are the highest in low-income households, and the lowest in high-income households (Table 9.6).

Table 9.6: Elasticities in six SEE countries by income group

		ALB	B&H	KSV	MNE	NMK	SRB
Price	Low	-1.198	-1.411	-0.532	-1.300	-0.446	-1.076
	Middle	0.00	-0.929	-0.630	-1.009	-0.888	-0.631
	High	-0.709	-0.708	0.00	-0.617	-0.278	-0.220
Income	Low	1.728	0.901	0.668	0.514	1.245	1.363
	Middle	1.141	0.782	0.894	0.522	1.124	1.267
	High	0.517	0.735	0.619	0.607	0.583	0.740

Such results mean that the population of smokers with the lowest income are the most sensitive to changes in income, while in the majority of countries, they are also the most sensitive group to changes in prices. Therefore, rapid growth in prices would result in the most intensive response in the low-income group in reducing their consumption. On the other hand, high-income households do not react as intensively to changes in prices and income.

Table 9.7: Impact of tax and price increase on consumption (by income group and total)

	ALB <sup>1</sup>	B&H <sup>2</sup>	KSV <sup>1</sup>	MNE <sup>3</sup>	NMK <sup>2</sup>	SRB <sup>1</sup>
Low	-27.1%	-22.1%	-16.3%	-8.7%	-11.6%	-21.6%
Middle	-4.8%	-14.0%	-18.4%	-8.3%	-17.3%	-11.8%
High	-16.4%	-10.3%	1.7%	-5.8%	2.4%	-4.0%
<b>Total</b>	<b>-15.0%</b>	<b>-14.6%</b>	<b>-11.1%</b>	<b>-7.5%</b>	<b>-8.1%</b>	<b>-11.0%</b>

<sup>1</sup> Albania, Kosovo, and Serbia simulate the impact of an excise tax increase which would result in a 25 percent price increase;

<sup>2</sup> B&H and North Macedonia simulate impact of a 25 percent excise tax increase;

<sup>3</sup> Simulation for Montenegro includes both changes in specific and ad valorem excise, resulting in 15.8 percent increase in price

**An increase in cigarette prices would result in a decrease in consumption.** The results indicate that a price increase would result in consumption decrease in all countries (Table 9.7). The highest impact would be on consumption in the low-income households, while the high-income households would see the lowest change.

Table 9.8: Impact of tax and price increase on government revenues (by income group and total)

	ALB <sup>1</sup>	B&H <sup>2</sup>	KSV <sup>1</sup>	MNE <sup>3</sup>	NMK <sup>2</sup>	SRB <sup>1</sup>
Low	1.1%	-6.4%	18.9%	9.9%	8.4%	3.5%
Middle	32.1%	3.3%	15.9%	10.5%	1.3%	16.3%
High	15.9%	7.7%	44.4%	13.5%	25.5%	26.7%
<b>Total</b>	<b>17.9%</b>	<b>2.5%</b>	<b>26.2%</b>	<b>11.3%</b>	<b>12.6%</b>	<b>17.4%</b>

<sup>1</sup> Albania, Kosovo, and Serbia simulate the impact of an excise tax increase which would result in a 25 percent price increase; <sup>2</sup> B&H and North Macedonia simulate impact of a 25 excise tax increase; <sup>3</sup> Simulation for Montenegro includes both changes in specific and ad valorem excise, resulting in 15.8 percent increase in price

**An increase in cigarette prices would result in an increase in government revenue from tobacco taxation.** The results indicate a price increase would result in government revenues in all countries (Table 9.8). The lowest tax burden would be borne by low-income house-

holds, while high-income households would contribute the most to government revenue, confirming the progressivity of increase of excise levels in all the countries.