Tobacco price elasticity in Serbia: Estimates of the prevalence and intensity elasticities and the effects increasing excises on the government revenues and consumption inequality

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ABSTRACT

Consumption of cigarettes and other tobacco products in the Republic of Serbia as well as in the other countries in the Southeastern Europe region imposes a significant economic burden on households and society in general. The aim of this paper is to estimate the effects of the cigarette price increase through tobacco excise increases and their associated impacts on tobacco consumption, household expenditures, and tax burdens among different income groups as well as the impact of these increases on government revenues. Lack of the research and evidence-based findings about tobacco taxation in Serbia makes excise system less effective and cigarettes more affordable. Strong evidence-based research findings can help policymakers to bring new laws and protect the population from the harmful and unhealthy effects of tobacco consumption. Using individual data from Household Budget Survey for years 2006 to 2017 and implementing Two-Part model, we estimated the cigarette prevalence and conditional elasticities. Our results show that increasing excises and prices of cigarettes in Serbia would result in lower cigarette consumption, while at the same time an increase of the government revenues would occur. Further positive fiscal effects could be expected since the decrease of cigarette consumption would likely lower health expenditures related to the harmful effects of cigarettes. Considering these divergent consumer responses to cigarette price increases, increasing excises would actually be a pro-poor policy that has the potential to lower the consumption 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.

Keywords: tobacco, price elasticity, excise, government revenues, inequality, Serba

1. Introduction

According to the World Health Organization (WHO), the consumption of tobacco products kills over 8 billion people a year, and this number could be even higher if the adoption and implementation of tobacco control policies are missing. Previous research conducted in developing countries showed that tobacco taxes are an essential instrument to control the consumption of cigarettes and other tobacco products (U.S National Cancer Institute and WHO, 2016). In low- and middle-income countries, the tobacco taxation policy has an impact on the decision of smokers to quit as well as to reduce the intensity of smoking.

Tobacco price elasticities are a measure of consumers responce to changes in prices of tobacco products. Price elasticities are important for creating effective tobacco tax policies

aiming to reduce negative externalities of tobacco smoking. Previous studies indicated negative tobacco price elasticities, typically ranging from -0.25 to -0.5 for high-income countries (Chaloupka et al. 2012), around -0.5 for low and middle-income countries, although the estimates for the developing countries are more variable (U.S National Cancer Institute and WHO, 2016).

Serbia is a middle-income country located in Southeastern Europe (SEE) with a very high cigarette prevalence rate - 29.2 percent of daily smokers compared to 18.4 percent for EU (Eurostat, 2014). According to the available data published by the Institute for Public Health „Batut", the prevalence rate is even higher if occasional smokers are included – 38 percent. The young population is also affected by the tobacco epidemic, 16.2 percent of the population aged 13-15 consuming cigarettes with increasing tendencies. The Ministry of Finance and Tobacco Administration Department of Serbia recorded the level of cigarette wholesale in 2018 - 655.5 million packs, while the weighted average price of cigarettes was €2.05 per pack. The EU 28 average price of cigarettes is €4.8 per pack, which is significantly above the prices in Serbia (European Commission, 2018).

The tobacco tax system in Serbia includes a mixed excise system, value-added taxes (VAT) and import taxes/duties as well. All tobacco products are subject to excise duty, but at the same time, the Law on Tobacco and Excise Law defines the current tobacco excise tax policy. In 2018, the total tax burden was consisting of specific excise (€0.58), ad valorem excise (33 percent - €0.69), and 20 percent VAT (€0.34). The current excise burden of about €1.25 per pack of 20 cigarettes is lower than the minimum excise duty of €1.8 per pack recommended by the EU. It is expected that, in the process of harmonization with the EU standards, the Serbia will need to follow the recommendation and to increase the excises to this level (European Commission, 2018). According to official data, 95 percent of total consumption is cigarettes, so a significant part of government budget revenues comes from excise on this type of tobacco product (Zubovic et al., 2018).

Tobacco market in Serbia is characterized by the presence of large international companies (PMI, JTI and BAT) who bought national tobacco factories during the process of privatization. Also, one domestic greenfield investment occurred during the last 15 years. Production of cigarettes in those factories makes Serbia the fourth-largest producer of cigarettes in Europe (SORS, 2018). At the same time, the export of cigarettes from Serbia is increased compared to the period before privatization; however the import of raw tobacco increased in the approximately same amount. On the other side, the employment in the tobacco sector is now less than 0.1 percent of the total and has a downward trend.

The aim of this paper is to estimate the overall tobacco price and income elasticities, elasticities by different income groups as well as the effects of changes in excises on government budget revenues and household consumption. Previous research for Serbia, using aggregate time-series data for the period 2002-2016, showed that the price elasticity ranged between -0.76 and -0.62 while the income elasticity is ranged between 0.34 and 0.39 (Jovanovic et al., 2018). The results are similar to other SEE countries; price elasticities are in the range from -0.47 in North Macedonia up to -0.83 in Bosnia-Herzegovina (Zubovic et al., 2018). However, these results are doubltable as they rely on a low number of observations.

This paper uses nationally representative Household Budget Survey (HBS) data from 2006 to 2017 and the theoretical framework of the two-part model developed by Mullahy and Manning (Mullahy, 1998; Manning, and Mullahy, 2001) to estimate the overall demand elasticity.

After this introduction, a detailed explanation of the methodology is presented in section 2. Data and descriptive statistics about prevalence, expenditures on tobacco and the number of consumed cigarettes based on HBS are presented in section 3, while sections 4 and 5 present and discusses the results of the estimation of tobacco price elasticity in the overall sample and by income groups, respectively. In section 6 the estimated elasticities are utilized to simulate the effect of price increases on overall cigarette consumption and government revenues (section 6). Finally, conclusions and recommendations are prepared based on key research findings in section 7.

2. Methodology

2.1. Estimation of the price elasticity of demand

Cigarette consumption is often characterised 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

$$y=0,\ n = 0, 1, \ldots n_i$$

$$y>0,\ n = n_{i+1}, n_{i+2}, \ldots n_N \qquad (1)$$

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 (Belotti et al., 2015) to model the two decisions independently. This model is well suited for cigarette use, as the proportion of non-smokers (y=0) is globally high. The WHO estimates the proportion of smokers to be approximately 21 percent (WHO, 2017). 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. For this part of the analysis, the Deaton (1988) demand model is used with the GLM (Generalized Linear Model) 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.

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[1] 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 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.

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 and variables representing institutional changes relevant to cigarette consumption. Next, the models estimating the prevalence and then the intensity elasticity of cigarettes use are presented.

2.1.1. Estimation of the prevalence elasticity

The first part of the model analyses 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; while 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 β_1 and β_2, as well as the vector of the coefficients Γ, 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 (Green, 2008). Therefore, the marginal effects of the price are calculated as

[1] A primary sampling unit is used if the municipality identifier is not available. This applies to prevalence and GLM models for robustness check, while the Deaton model initialy 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.

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

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 (Green, 2008).

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 consumption at the household level increases by ξ_{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

The Deaton (1988) 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 the 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 (John, 2008b). 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 (Deaton 1997):

$$w_{hc} = \alpha^0 + \beta^0 lnx_{hc} + \gamma^0 . z_{hc} + \theta lnp_c + (f_c + u_{ch}^0) \quad (6)$$

$$lnv_{hc} = \alpha^1 + \beta^1 lnx_{hc} + \gamma^1 . z_{hc} + \psi lnp_c + u_{hc}^1 \quad (7)$$

where indices *h* and *c* represent households and clusters, respectively. The left-hand side variables in equations (6) and (7) 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 the first equation f_c present the cluster level effects on the budget share, which are assumed to be uncorrelated with the price effect on the budget share (John, 2008b). Since the prices are not observed, the parameters θ and ψ cannot be directly estimated from equations (6) and (7). 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 (Frisch-Waugh, 1933).

In the unit value equation (equation 7), coefficient β^1 represents the expenditure elasticity, while ψ 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 ψ would be equal to one (as the change of the unit value would correspond to change of the price) and β^1 would be approximately equal to zero. On the other hand, in the presence of quality shading, ψ will be less than one (unit value change will be slower than the change of the price) and β^1 would be higher than 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

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

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

The estimation of the parameter θ, 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 result is parameter ϕ, a hybrid of price and quality elasticity. Deaton proves that $\phi = \psi^{-1}\theta$ (Deaton, 1990).

In the third stage, the weak separability assumption is introduced. Given the budget share is defined as the product of the number of cigarettes and unit value divided by total expenditures, parameter θ can be estimated as (Deaton, 1997):

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

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 (Deaton, 1997):

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

Similarly, since equation (8) has budget shares instead of the logarithm of quantity, parameter β^0 does not estimate the expenditure elasticity. Instead, the total elasticity of expenditure can be estimated as (Deaton, 1997):

$$\hat{\epsilon}_i = 1 - \hat{\beta}^1 + (\frac{\hat{\beta}^0}{w}) \qquad (12).$$

Following John (2008b), 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.

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

As mentioned in the introduction, the second part of the analysis estimates the price and income elasticity of demand by income group. Income groups are constructed on the basis of total household consumption (a proxy for income) per capita. Given the relatively small sample size, three income groups are created: low-income, middle-income, and high-income. 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 the use of formula for total elasticity to calculate total elasticity by income group.[2]

2.3. Simulation of the impact of price and excise increase on consumption and government revenue

Finally, the estimated price and income elasticities are used to simulate the impact of price and excise tax increase on consumption and government revenue. The total price and income elasticities are calculated as a corrected sum of prevalence elasticity and intensity (that is, conditional demand) elasticity. 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 cigarettes packs for the year for which latest HBS is available. 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. 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:

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

[2] The prevalence model, as well as the model for estimation of the conditional demand (intensity), uses the price proxy calculated based on the unit values from the the overall sample. Therefore, all households, regardless of the income groups they belong to, are "facing" the same price.

where D_{t+1} is the new demand, D_t is the demand in year *t*, ξ_p and ξ_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 are calculated for a single cigarette pack according to the current taxation rules in Serbia and this rule is applied to the weighted average price of cigarettes in year *t*. The change in price that would occur in year *t+1* is simulated, and the impact on excise and VAT for year *t+1* is calculated. 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 (17). Data are presented in euros.

3. 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 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. Moreover, households have decreased their smoking intensity because the average number of cigarettes smoked in the same period decreased from 39.1 to 27.2 packs per household per month.[3]

At the same time, 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 1: Cigarette use in Serbia: prevalence, expenditures, number of consumed cigarettes

Year	Smoking prevalence (% of households)	Average number of cigarettes smoked (packs	Average real household expenditure on cigarettes	Average real price (in RSD)[1 2 3]

[3] 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 our results.

		per household) [1]	(in RSD)[1] [2]	
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: Own calculation based on the HBS data for Serbia

[1] Based on reported expenditure and quantities of households with positive expenditure on cigarettes.

[2] Variables deflated by CPI to 2006 values.

[3] 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 are used as a proxy for cigarette price.[4] Yearly trends of this variable are presented in the last column of Table 1. The average real price (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.[5]

Therefore, while the prices of cigarettes more than doubled in real terms over the observed years, during the same period both smoking prevalence and smoking intensity decreased. The next section discusses the regression analysis in order to analyse the effect of prices on smoking prevalence and intensity while controlling for the impact of other variables.

4. 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. Different models were observed in order to find the one who passes all specification tests. In this paper, authors present the Model 4.

4.1. Prevalence elasticity

According to the estimates, 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. or by 0.9 percentage points in absolute terms.

[4] 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.

[5] 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.

All other things equal, households with higher income (that is, higher total expenditure) 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 orby about 1.8 percentage points in absolute terms. Also, the prevalence is higher in larger households with higher shares of men and adults. Findings indicate that the lowest prevalence is associated with incomplete primary education and the highest levels of education. The region is also a significant variable in the model. Belgrade is a region with a lower prevalence rate compared to the other three regions. Employment status affects the consumption of tobacco product – unemployed households have a higher prevalence than employed. Also, the implementation of the advertisement ban in 2010 has reduced smoking prevalence.

4.2. Conditional demand (intensity) elasticity

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. If cigarette prices in Serbia increased by 10 percent, the number of cigarettes consumed by those who smoke would decrease by about 4 percent.

4.3. Total price and income demand elasticity

Based on the estimates above, total demand elasticity is calculated. The conditional demand elasticity is corrected for the change in the number of smokers, which occurs due to the increase/decrease in the prevalence. Table 2 presents the estimates of the total demand elasticity using the Deaton model.[6] Total price elasticity amounts to -0.659, while the total income elasticity is 1.058. 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 10.6 percent higher demand for cigarettes.

Table 2: Total demand elasticity using Deaton model

		Conditional demand estimate from Deaton model	
Total demand elasticity	price	-0.659	
	income	1.058	
Prevalence elasticity	price	-0.265***	(0.051)
	income	0.609***	(0.020)
Conditional intensity elasticity	price	-0.395***	(0.020)
	income	0.447***	(0.011)

Source: Own calculation based on HBS data
Cluster robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. 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

[6] The estimates of total demand elasticity using GLM for intensity elasticity is available upon request. The intencity elasticity is estimated at 0.413, while the overall elasticity is -0.714.

are formed based on the total household expenditure per capita each year. Total household expenditure is a proxy for household income: low-, middle-, and high-income.

5.1. Prevalence elasticity by income group

Table 3 shows that the price elasticity of smoking prevalence is the highest for low-income households, estimated at -0.565, as expected. The price elasticity of high-income households is not statistically significant suggesting that their decision to smoke is not impacted by the 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.

The analysis further indicates that in all income groups, higher income increases smoking prevalence. 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 percent higher smoking prevalence by low-, middle-, and high-income households, respectively.

Table 3: Prevalence and conditional demand elasticities by income group

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

Source: Own calculation based on HBS data
Notes: *** p<0.01, ** p<0.05, * p<0.1

5.2. Conditional demand (intensity) elasticity by income group

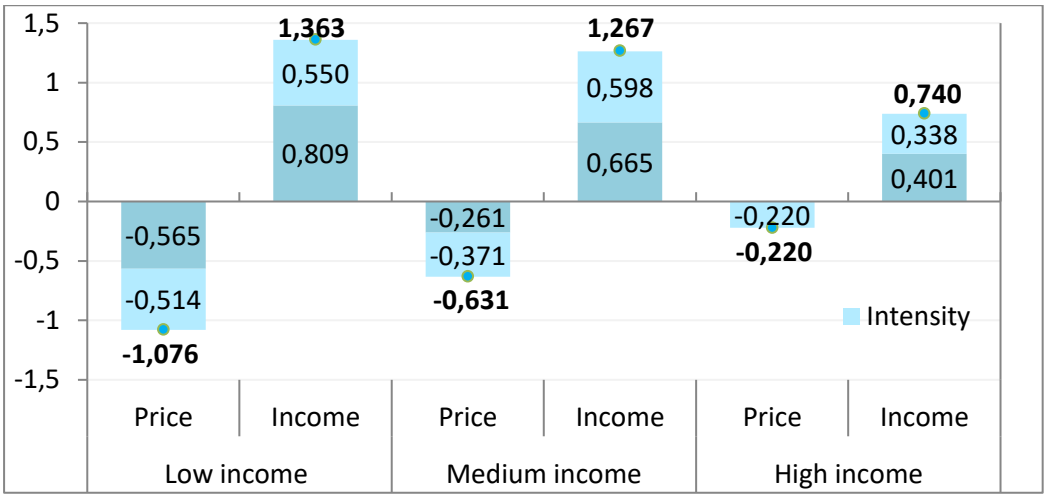
The conditional demand elasticity in each income group is estimated using the Deaton model. For the overall sample, price elasticity is estimated at -0.395, with an income elasticity of 0.447. If we look elasticities by income groups, the results indicate that an increase in cigarette prices by 10 percent, the demand 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 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.

5.3. 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 1.[7]

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. Finally, elasticity is the lowest in the high-income group at -0.220 and the effect is entirely attributable to a decrease in smoking intensity because prices have no significant effect on prevalence.

Figure 1: Total elasticity by income group



Source: Own calculation based on the estimated elasticities (Table 3)

6. Impact of price increases on consumption and government revenues

Consumer response to the changes in cigarette prices often decreases the demand for cigarettes, the effects of the price increase are important for policymakers, especially in cases when the excise rate is changed. This section discusses the economic implications of the estimated price and income elasticities of cigarette consumption in Serbia. The findings presented in the previous section are used to simulate the effects. Total government revenue contains from the taxes on the cigarettes, including both excise and value-added tax. 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). The specific excise was €0.53 per pack (64.75 RSD), ad valorem excise €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, while the total tax paid on a pack of cigarettes in Serbia amounts to €1.46. It represents about 78.8 percent of the total retail price. The estimated total government revenue from cigarette consumption in 2017 was about 982 million euros (or 6.9 percent of the total government tax revenues).

[7] 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.

The total price and income elasticities are estimated at -0.659 and 1.058 (Table 2), respectively. According to the Statistical Office of the Republic of Serbia, total household consumption grew in 2018 by 3.0 percent. Detailed below are simulations of a price increase of 10 percent, 25 percent, and 50 percent on cigarette consumption and government revenues from cigarettes 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 at the same levels as they are. In government revenue simulations, it is assumed that producers are not going to change their net-of-tax prices.

The change in consumption and government revenues where prices increase by 10, 25, and 50 percent are shown in Table 4.

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.[8]

Table 4. Impact of price increases on consumption and government revenues

		Price	Consumption		Revenue	
		(Euros)	(Million packs)	(% change)	(Million euros)	(% change)
Baseline		1.87	671.4	0	982.0	0
	Price increase	New price				
Scenario	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: Own calculation based on Ministry of finance data and estimated elasticities

[1] In million packs; [2] In million euros
Source: Own calculation based on Ministry of finance data and estimated elasticities

6.1. 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. 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 1) are used to estimate the change in cigarette consumption and tax revenues in 2018.

Table 5 presents the results of the simulation. As expected, the low-income group experiences 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 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

[8] https://tobacconomics.org/wp-content/uploads/2018/08/Tobacco-and-SDG-Brief-FINAL.pdf

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 5. Impact of price increase on consumption and expenditure by income group

Income group	Consumption			Spending on tobacco		
	Baseline[1]	Scenario[1]	Change	Baseline[2]	Scenario[2]	Change
Low	162.0	127.0	-21.6%	302.9	296.9	-2.0%
Middle	238.4	210.1	-11.8%	445.8	491.2	10.2%
High	271.0	260.1	-4.0%	506.8	608.0	20.0%

[1] In million packs; [2] In million euros
Source: Own calculation based on Ministry of finance data and estimated elasticities

7. Discussion and conclusions

In this research we estimated the prevalence and intencity elasticity in the Serbia by using the Household Budget Survey data for the twelve-year period and the methodological framework of the two-part model (Mullahy, 1998; Manning, and Mullahy, 2001). 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. These elasticities are then used in the back-of-the-envelope estimation of the changes in the government revenues that would occur if the prices (i.e. the excises change). The 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.

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. The estimated elasticities by income group are then then used in the back-of-the-envelope estimation to estimate the change in the income groups' consumption that would occur if the prices (i.e. the excises change). The estimation indicates that 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.

From a policy perspective, our results show that increasing excises and prices of cigarettes in Serbia would result in lower cigarette consumption, while at the same time an increase of the government revenues would occur. Further positive fiscal effects could be expected since the decrease of cigarette consumption would likely lower health expenditures related to the harmful effects of cigarettes. Considering these divergent consumer responses to cigarette price increases, increasing excises would actually be a pro-poor policy that has the potential to lower the consumption 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.

Strong evidence-based research findings that can help policymakers to bring new laws and protect the population from the harmful and unhealthy effects of tobacco consumption. In this research we show that increasing prices and excises would have positive effects on government revenues and consumption inequality. From a wider policy perspective, increasing prices and excises on tobacco products would lower the harmful effects of cigarettes, which should be the main aim of the excise taxes, as well as one of the main aims of the policy makers in general.

Disclaimer

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