Effectiveness of tax policy changes in Montenegro: smoking behaviour by socio-economic status

Mirjana Cizmovic, Ana Mugosa, Milica Kovacevic, Tanja Lakovic

ABSTRACT

Background  The main goal of this study was to examine the responsiveness of smoking prevalence and cigarette consumption to price and income changes by income groups and the effectiveness of tax policy changes to reduce cigarette consumption in Montenegro.

Data and methods  A two-part model was applied to estimate smoking participation, smoking intensity price and income elasticity. The first part of the model applies logit regression, while the second uses Deaton’s model to improve the validity and objectivity of conditional (smoking intensity) elasticity results. A generalised linear model (GLM) was applied to verify robustness. The reason for this is that Deaton’s model is commonly used in the analysis of Household Budget Survey (HBS) data, especially when households do not report the market price. Moreover, using this model, it is possible to capture the shifting of quality to price change. The analysis used HBS data (2006–2017).

Results  The estimates indicate that tobacco pricing policies had a much higher impact on smoking prevalence in the low-income group (price elasticity of −0.595) relative to the high-income group (price elasticity of −0.344). The same conclusion could be drawn for the smoking intensity elasticity; the high-income group was the least affected by changes in price (price elasticity of −0.258). At the same time, the most affected was the low-income group, with price elasticity of −0.424. Poorer households spent a larger share of their budget on cigarettes. The simulation results confirm that increases in the specific excise taxes of 58.3% on tobacco would reduce total cigarette consumption by 8.07%.

Conclusion  Smoking prevalence and consumption are very responsive to price and income changes, with considerable differences in elasticities between income groups. The taxation policy has a positive impact on changing patterns of consumption and public revenues across each income group. Low-income and middle-income households would benefit the most, while on the other hand, the highest revenue collection was generated from the wealthiest group. Our results align with results obtained so far for other low-income and middle-income countries. This paper contributes to the analysis of the smoking prevalence and cigarette consumption responsiveness to price and income changes, which was conducted for the first time in Montenegro.

INTRODUCTION

Tobacco use is causing over 8 million deaths each year globally, whereas the poor population is more likely to use tobacco, which increases inequities, deepening poverty and growing health disparities. Existing results show that the low-income group spends a relatively larger share of their budget on cigarettes than the high-income group while sacrificing the spending on basic necessities.

Global evidence confirms that the tobacco taxation policy is one of the most effective tools to reduce smoking prevalence, specifically among the poor and young populations. Raising tobacco taxes, to account for at least 70% of retail prices, would lead to significant price increases, affecting smokers by different behavioural mechanisms (preventing initiation, promoting cessation and reducing the frequency and quantity of tobacco consumed). Nevertheless, the effectiveness of taxation on smoking prevalence and consumption may differ depending on different socio-economic status.

The impact of price changes on tobacco prevalence and consumption is a subject of various studies related to the economics of tobacco taxation. Generally, the estimates from low-income and middle-income countries (LMICs) suggest that the total price demand elasticity varies between −0.4 and −0.9, which is higher than that in high-income countries, ranging from −0.2 to −0.6. Studies based on Household Budget Survey (HBS) data for 13 LMICs, the total price demand elasticity is equal to approximately −0.53; smoking participation price elasticity, −0.36; and conditional price elasticity, −0.17. Studies based on Household Budget Survey (HBS) data (LMICs) report similar results, with total price demand elasticity ranging from −0.41 to −0.84, smoking participation price elasticity from −0.01 to −0.36 and conditional price elasticity from −0.20 to 0.74.

Considering socio-economic status, the empirical evidence confirms a higher total demand price elasticity among poorer households (−0.7 to −1.41), compared with high-income groups (−0.36 to −0.8).

Furthermore, empirical evidence suggests that the type of country and its stage of the tobacco epidemic are important factors in policy decision making. Results from six LMICs and eight upper-middle-income countries (UMICs) confirm that higher prices can be used to reduce smoking by deterring initiation in LMICs while promoting cessation in UMICs. This fact could be important for the government tobacco taxation policy to enhance the capacity of low-income smokers to quit tobacco use. Over the last decade, the Government of Montenegro, as a signatory of the WHO’s Framework Convention on Tobacco Control, encouraged reducing tobacco product use through a set of non-price and price measures. To achieve further reductions, the Government of Montenegro
The main goal of this paper is to examine the responsiveness of smoking prevalence and cigarette consumption to price and income changes in Montenegro, as well as the impact of tax policy changes on cigarette consumption and government revenues. The government calendar of excise tax increases includes a move toward greater reliance on specific taxes on tobacco rather than ad valorem. This schedule assumes an increase in the price.22 However, the cigarette prices are still lower than the EU level, and the smoking prevalence (40.7%) is one of the highest in the EU region.23–26 A comparison of tobacco prevalence and consumption in Balkan countries and the European Union (EU 28) is given as an average in Table 1.

### Table 1 Prevalence and consumption levels—Balkan and European Union

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence (%)</th>
<th>Consumption (the average number of cigarettes smoked per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montenegro</td>
<td>40.7</td>
<td>19.5</td>
</tr>
<tr>
<td>Macedonia</td>
<td>48.4</td>
<td>12.7</td>
</tr>
<tr>
<td>Serbia</td>
<td>38.0</td>
<td>17.3</td>
</tr>
<tr>
<td>Albania</td>
<td>24.8</td>
<td>15.8</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>40.0</td>
<td>17.9</td>
</tr>
<tr>
<td>Kosovo</td>
<td>35.3</td>
<td>20.7</td>
</tr>
<tr>
<td>European Union (EU 28)*</td>
<td>26</td>
<td>14.1</td>
</tr>
</tbody>
</table>

Source: Survey on Tobacco Consumption in South Eastern European countries (STC-SEE), 2020 and WHO.24

HBS provides information on average household consumption, expenditure, size and structure, as well as detailed information on their demographic characteristics. Using this information, we included the following indicators in the analysis:

- The unit value, which is defined as the ratio of monthly household expenditure on cigarettes and the number of cigarette packs purchased by the household over the course of a month;
- The budget share, which is defined as the ratio of monthly household expenditure on cigarettes and the total household expenditures.15
- Total household expenditure reported (in EUR).

The analysis also controlled for socio-demographic characteristics, comprising:

- Household size.
- Male ratio, defined as the ratio of the number of males to household size.
- Adult ratio, defined as the ratio of the number of adults to household size;
- Household type defined by economic activity (unemployed, pensioners and employed).
- Maximum education, defined as years of education received by the most educated member in the household.

Trends in smoking prevalence, the quantity of cigarettes smoked, household expenditure on cigarettes and cigarette prices for the whole sample are reported in Table 2. The variable price is approximated with an average unit value per cluster, which is defined at the municipality–year level for each income group.

Smoking prevalence decreased during the observed period, while the number of cigarette packs consumed per month showed a decreasing trend from 2008 to 2014 and then increased after. A possible reason for the consumption increase could be a substitution for cheaper brands, cross-border transactions and illicit trade. Regarding average real household expenditure on cigarettes and prices, an increasing trend was visible throughout the observed period.

To gain a clearer picture of cigarette use in Montenegro, households were divided into three subgroups (low, middle and high income), according to total household expenditure per capita used as an approximation for household income. In this way, it was possible to analyse the structure of each subgroup relative to their average total expenditure, budget shares on cigarettes, consumption trends and smoking prevalence. Figure 1 shows an increasing price trend during the period observed, which impacted the reduction in smoking prevalence and quantity consumed across all income groups. The increase in price followed an increase in specific excise tax of 100% in 2010 compared with the previous year (from EUR 5 to 10 per 1000 sticks). The same tax increased to EUR 19 and 20 in 2014 and 2015, respectively (Figure 1). Nevertheless, the change in consumption trend in low-income and middle-income groups, starting from 2014, could be potentially explained by factors other than price, such as substitution to cheaper brands, illicit trade and cross-border transactions.

It is worrying that poor families spend a much larger share of their budget on cigarettes, sacrificing the spending on basic necessities and increasing inequities. Rich families can devote a much bigger portion of their spending on tobacco, which is reflected through the highest values of average real expenditures.

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**Data and descriptive statistics**

The HBS data for Montenegro from 2006 to 2017 (excluding 2016 when the survey was not conducted) were used to estimate the prevalence and conditional elasticity of demand for cigarettes. The data were obtained from the Statistical Office of Montenegro (Monstat). This survey was conducted annually, but only once in 1 month per year. Montenegro has a total of 21 municipalities across three regions: north, central and south. After removing outliers, the total sample comprised 12 503 households, while the average number of households per year was 1202.
Methodology

The two-part model is widely used in theoretical and empirical research in health economics, specifically in mixed discrete-continuous outcomes, using HBS data on the consumption of different goods. This model allows a separate analysis of smoking participation and intensity. In the first part, the logit model is applied to assess the probability of smoking participation, while the second part often uses generalised linear model (GLM) to estimate smoking intensity. However, the GLM method does not consider the problem of cigarette quality choice when estimating conditional price elasticity. Consequently, to obtain the validity of the results, the analysis incorporated the model introduced by Deaton and Muellbauer as the main model, by which conditional price elasticity was estimated among households with positive consumption. Deaton’s model takes into account quality choice (quality shading), which means retaining the same level of consumption but switching to cheaper brands due to the price increase. The support for this model could be found in the fact that Deaton’s methodology is commonly applied to HBS data, especially when households do not report the market price, which is the case of HBS in Montenegro. The GLM model was used to verify robustness.

In the first part of the two-part model, a dummy variable was formed to estimate the probability of smoking participation, taking 0 if there was no reported consumption of cigarettes in the household and 1 otherwise. The logit model was defined as follows:

\[
P(\text{reported consumption} = 1) = \phi (\beta_0 + \beta_1 \cdot \text{price} + \beta_2 \cdot \text{income} + \beta_3 \cdot Z)
\]  

(1)

Smoking participation is a function of the price per pack of cigarettes, income or total reported household expenditure and a vector of socio-demographic characteristics \(Z\). The regulatory variable was considered (amendments of tobacco control law) but excluded due to its statistically insignificant impact on smoking participation. The prevalence was calculated based on the assumption that the average prices (unit values) are different between income groups. Prevalence elasticity \(e_p\) was estimated using the following equation:

\[
e_p = M_p \cdot (p) = \frac{dP(Y=1)}{dp} \cdot p_i
\]  

(2)

where \(M_p\) stands for marginal effects and \(p_i\) represents price of cigarettes. Marginal effects are defined as an increase in probability of positive consumption of cigarettes due to the price increase.

Deaton’s model uses unit values as an approximation of price, which contains not only the information on price but also the quality of the product consumed. By including quality, it is possible to assess quality shading, meaning switching to cheaper brands, due to the price increase, with the same level of consumption. This is the reason that the model allows for the correction of final price elasticity for quality effects and eventual measurement errors. Additionally, the model assumes that unit values vary spatially between clusters but not within the cluster.

The model relies on two equations:

\[
w_{ic} = \alpha_0 + \beta_0 \cdot \ln p_{ic} + \gamma_0 \cdot z_{ic} + \omega_0 \cdot \ln \text{price} + u_{ic}^0
\]  

(3)

\[
\ln v_{ic} = \alpha_1 + \beta_1 \cdot \ln x_{ic} + \gamma_1 \cdot z_{ic} + \psi \cdot \ln \text{price} + u_{ic}^1
\]  

(4)

where dependent variables in (2) and (3) are the budget share and unit value, respectively (household \(i\) in cluster \(c\), the cluster is defined as a municipality \(x\) in the year \(t\)). The independent variables are as follows: the logarithm of total household expenditure (\(\ln x_{ic}\)); the vector of household socio-economic characteristics (\(z_{ic}\)); the logarithm of prices (\(\ln \text{price}\)); \(u_{ic}^0\) is the idiosyncratic error. Regression beta coefficient \(\beta_1\) of variable \(\ln x_{ic}\) in the unit value equation represents expenditure elasticity of quality, which measures the choice of quality due to changes in household income. The degree of unit value change due to one unit change in prices is represented by the coefficient \(\psi\). Using the information of the quality effects’ magnitude (\(\beta_1\)), it is possible to correct final price elasticity for quality shading.

Deaton’s model is complex, consisting of three stages: the first stage removes household socio-economic characteristics from both dependent variables; the second stage generates cluster averages of budget shares and unit values; the third stage separates the price and quality effects within the unit value.

Conditional price elasticity \(e_c\) according to Deaton’s methodology is estimated by the following equation:

\[
e_c = \frac{\theta}{\overline{w} - \psi}
\]  

(5)

where \(\overline{w}\) represents average budget share on tobacco, while \(\theta\) and \(\psi\) are the coefficients estimated in equations 3 and 4.

Total price elasticity is calculated by summing up estimated prevalence \(e_p\) and conditional elasticity \(e_c\).

The robustness of conditional elasticity was verified using the GLM methodology with family gamma and link log, which, by
applying the link function, transforms the probabilities of categorical response variable levels to a continuous numerical scale $(-\infty, +\infty)$:

$$E(Y) = g^{-1}(X\beta)$$

where $E(Y)$ is the expected variable, $g$ is the link function and $X\beta$ is the linear predictor. The model includes the same independent variables as the logit model.

RESULTS

Prevalence and conditional elasticity by income group

To estimate prevalence elasticity, several models were tested using different specifications of logistic regression. The best model was chosen according to the information criteria (Akaike information criterion (AIC), Bayesian information criterion (BIC) and log-likelihood) and passed all specification tests. This model uses the log-transformed price, income and squared log income variable, as well as socio-demographic characteristics of households.

The results from table 3 show heterogeneity in prevalence price elasticity estimates by income category. This estimate indicates that tobacco pricing policies have a stronger impact on smoking prevalence in poorer households (the highest price elasticity estimate was found in the low-income group), which is in line with previous research. Nevertheless, the prevalence price elasticities in low-income and middle-income groups are similar, with no statistically significant difference between them, which leads us to conclude that price increases would have a similar and strong impact in our country on the larger share of population, not only affecting a significant decrease in consumption among the poorer population but also in the middle-income group. As expected, the wealthiest are less responsive to price changes, as the price increase has a weaker impact on

Figure 1  Descriptive statistics by income groups in the period 2006 to 2017. (A) Price, defined as municipality–year average of cigarette unit values (ratio between total expenditure and quantity) expressed in real terms (2010=100) and smoking prevalence, defined as the share of households with positive tobacco consumption in the total number of households; (B) price and smoking intensity, defined as the number of cigarette packs smoked per month per household with positive expenditures on cigarettes; (C) price and average real household expenditure on cigarettes per month per household in EUR; (D) price and household budget share spent on cigarettes per month (ratio of monthly household expenditure on cigarettes and the total household expenditures); (E) adult ratio—percentage of household members older than 15 years; male ratio—proportion of males in a household; percentage of pensioners, unemployed and employed household members. Yellow lines in panels A–D show the year when the most important changes in excise taxes occurred during the period observed. Source: own calculation using HBS data obtained from Monstat.
their smoking behaviour. Unlike price elasticity, the estimates of income elasticity are approximately the same and with no statistically significant differences across groups.

Analysing the associations between the prevalence and socio-demographic characteristics of households among income groups, it is concluded that smoking prevalence is more likely to be higher in larger households and households with more men, adults and unemployed members. Those with lower educational attainment of the most educated member are more likely to smoke compared with households with higher education level of the most educated member. On the other hand, households with more pensioners are less likely to smoke.

Deaton’s model (table 4) showed diversity regarding changes in consumption patterns due to price increases among income groups. Even though tests showed the absence of statistically significant differences among all income groups, the magnitude of elasticity estimates may indicate that rich households are less affected by the changes in price (price elasticity of −0.258) compared with the poorer group (price elasticity of −0.424). Based on the sign and the value of socio-demographic variables, we can conclude that among all income groups, larger households and households with more men, adults and pensioners pay lower prices. Pensioners and unemployed household pay less for cigarettes compared with employed. Households with more men, adults and employed are likely to spend a higher budget on cigarettes.

Results confirm the presence of quality effects (by which the adequacy of using the Deaton model is approved), with the lowest quality elasticity in the low-income group which equals 0.15. The estimate indicates that these households would tend to increase the chosen unit value by 1.5% in case of an increase in total expenditure by 10%, controlling for other socio-demographic variables. Cluster fixed effects are significant and indicate substantial time and spatial variation in each income group, approving the validity of the main Deaton model assumption that unit values vary between clusters (the same applies to budget share equation). The obtained results are consistent with the results of research conducted in other LMICs.7 9 12 30 We used the GLM methodology to verify robustness, which generated similar results (provided in online supplemental material).

Table 3  Prevalence elasticities and socio-demographic characteristics by income groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Low-income households</th>
<th>Middle-income households</th>
<th>High-income households</th>
<th>All households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence elasticity (logit model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>−0.595*** (0.067)</td>
<td>−0.582*** (0.064)</td>
<td>−0.344*** (0.074)</td>
<td>−0.521*** (0.039)</td>
</tr>
<tr>
<td>Income</td>
<td>0.328*** (0.052)</td>
<td>0.255*** (0.069)</td>
<td>0.296** (0.060)</td>
<td>0.325*** (0.025)</td>
</tr>
<tr>
<td>Household size</td>
<td>0.077*** (0.029)</td>
<td>0.160*** (0.049)</td>
<td>0.037 (0.046)</td>
<td>0.051*** (0.015)</td>
</tr>
<tr>
<td>Male ratio</td>
<td>0.452*** (0.167)</td>
<td>0.835*** (0.150)</td>
<td>0.872*** (0.102)</td>
<td>0.794*** (0.074)</td>
</tr>
<tr>
<td>Adult ratio</td>
<td>0.529*** (0.171)</td>
<td>0.606*** (0.207)</td>
<td>0.328 (0.287)</td>
<td>0.545*** (0.119)</td>
</tr>
<tr>
<td>Maximum education: more than secondary complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>0.522 (0.329)</td>
<td>0.252 (0.327)</td>
<td>0.436 (0.273)</td>
<td>0.407*** (0.175)</td>
</tr>
<tr>
<td>Primary complete</td>
<td>0.245** (0.118)</td>
<td>0.395*** (0.122)</td>
<td>0.321*** (0.115)</td>
<td>0.304*** (0.067)</td>
</tr>
<tr>
<td>Secondary complete</td>
<td>0.215** (0.089)</td>
<td>0.230** (0.082)</td>
<td>0.255*** (0.079)</td>
<td>0.232*** (0.047)</td>
</tr>
<tr>
<td>Region: centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>−0.064 (0.117)</td>
<td>−0.221* (0.101)</td>
<td>−0.487*** (0.078)</td>
<td>−0.320*** (0.054)</td>
</tr>
<tr>
<td>North</td>
<td>−0.439*** (0.072)</td>
<td>−0.345*** (0.077)</td>
<td>−0.208*** (0.099)</td>
<td>−0.379*** (0.046)</td>
</tr>
<tr>
<td>HH activity: employed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.367*** (0.136)</td>
<td>0.436 (0.236)</td>
<td>0.031 (0.310)</td>
<td>0.295*** (0.109)</td>
</tr>
<tr>
<td>Pensioners</td>
<td>−0.146 (0.098)</td>
<td>−0.188** (0.095)</td>
<td>−0.473*** (0.085)</td>
<td>−0.310*** (0.052)</td>
</tr>
<tr>
<td>Constant</td>
<td>−8.820*** (2.943)</td>
<td>−20.202*** (4.075)</td>
<td>−23.203*** (4.710)</td>
<td>−12.404*** (1.790)</td>
</tr>
<tr>
<td>Observations</td>
<td>4172</td>
<td>4167</td>
<td>4164</td>
<td>12 503</td>
</tr>
</tbody>
</table>

Source: Own calculation; ***p<0.01, **p<0.05, *p<0.1.

Link test results showed that the linear predicted value squared is not statistically significant (p=0.241). Hosmer and Lemeshow’s (HL) goodness of fit test indicates that our model fits the data well; the optimal number of groups of data used in the test is 1253, χ²=1385.41, prob >χ²=0.6531. Multicollinearity is not an issue—mean VIF is 1.45, and VIF income and income squared are 1.81 and 1.19, respectively. There is no statistically significant difference between price elasticities of low-income and middle-income groups (χ²_1(1)=0.08, prob >χ²=0.7712). A statistically significant difference between price elasticities of low-income and high-income group is confirmed (χ²_1(1)=6.13, prob >χ²=0.0033), as well as between middle-income and high-income groups (χ²_1(1)=7.53, prob >χ²=0.0061). The results showed the absence of statistically significant difference between income elasticities among all income groups: low-income and middle-income groups (χ²_1(1)=0.63, prob >χ²=0.4284); low-income and high-income groups (χ²_1(1)=0.16, prob >χ²=0.6860); middle-income and high-income groups (χ²_1(1)=0.18, prob >χ²=0.6730). HH activity: If there is at least one member of the household who is employed, the household is defined as employed; if there are no employees, but there is a pensioner in the household, the household is defined as a pensioner; if the adult household members are all inactive or unemployed, the household is labelled as unemployed.

Total price and income elasticity

The price of cigarettes had a negative and statistically significant impact on smoking participation and conditional cigarette demand. These results demonstrate that cigarette price increases would decrease the number of smokers and the quantity consumed. As a sum of participation and conditional intensity elasticity, the obtained total demand price elasticity was equal to −1.019 in the low-income and −0.602 in the high-income group (table 5). SEs of price and income elasticities were estimated using a bootstrap of 1000 replications.

As expected, the low-income group was the most affected by the changes in price compared with the wealthier peers. Test results showed statistically significant difference between elasticity estimates of these two groups, as well as between middle-income and high-income households. The absence of statistically significant difference between total price elasticities in low-income and middle-income groups implies similar response on cigarettes price change on the larger share of population. The values of estimated elasticities are in line with previously conducted research in LMICs.7 9 11 12 30

Impact of price increase on consumption and government revenues

This part of the research aims to simulate the effects of excise tax changes on cigarette consumption and fiscal revenues. The
The real consumption growth rate is 4.1%, calculated based on used cigarette consumption calculated based on used

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is EUR 2.1.33

Specific excise is EUR 0.6 per pack, ad valorem 32%.34

Due to the unavailability of cigarette market prices in HBS, WAPC was the only applicable price in the simulations. Although it is common to use WAPC as a base for this type of simulation, it can cause the under/overestimation of simulated results. Using different retail prices would better reflect the realities of tobacco taxation policies, due to the more precise estimation of

Simulation was based on the assumption that the supply function is perfectly elastic and that, consequently, the whole tax burden is on the consumers.34 The simulation was constructed under the following baseline scenario assumptions (the year 2019):

- Baseline cigarette consumption calculated based on used excise stamps, obtained from the Ministry of Finance: 26 549 828.
- The real consumption growth rate is 4.1%, calculated based on final consumption from national accounts.

Table 4 Conditional elasticities and socio-demographic characteristics by income groups

<table>
<thead>
<tr>
<th>Conditional demand (intensity) elasticity (Deaton model)</th>
<th>Low-income households</th>
<th>Middle-income households</th>
<th>High-income households</th>
<th>All households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price -0.424*** (0.049)</td>
<td>-0.339*** (0.067)</td>
<td>-0.258*** (0.142)</td>
<td>-0.359*** (0.044)</td>
<td></td>
</tr>
<tr>
<td>Income 0.174** (0.085)</td>
<td>0.241*</td>
<td>0.276</td>
<td>0.267</td>
<td></td>
</tr>
<tr>
<td>Total expenditure (ln) 0.148***</td>
<td>-0.034***</td>
<td>0.208***</td>
<td>0.237***</td>
<td>-0.021***</td>
</tr>
<tr>
<td>Household size (ln) -0.077***</td>
<td>0.005</td>
<td>-0.139**</td>
<td>-0.129***</td>
<td>0.000</td>
</tr>
<tr>
<td>Male ratio -0.077***</td>
<td>0.009**</td>
<td>0.012</td>
<td>0.018**</td>
<td>-0.033</td>
</tr>
<tr>
<td>Adult ratio -0.108***</td>
<td>0.008*</td>
<td>-0.152***</td>
<td>0.004</td>
<td>-0.168***</td>
</tr>
<tr>
<td>Maximum education: more than secondary complete No education -0.144*</td>
<td>0.073***</td>
<td>-0.107</td>
<td>0.002</td>
<td>-0.068</td>
</tr>
<tr>
<td>Primary complete -0.066***</td>
<td>0.006*</td>
<td>-0.092***</td>
<td>0.000</td>
<td>-0.110***</td>
</tr>
<tr>
<td>Secondary complete -0.034*</td>
<td>0.003</td>
<td>-0.025</td>
<td>0.002</td>
<td>-0.073***</td>
</tr>
<tr>
<td>HH activity: employed Unemployed -0.025</td>
<td>-0.002</td>
<td>-0.076*</td>
<td>0.004</td>
<td>-0.111*</td>
</tr>
<tr>
<td>Pensions -0.074***</td>
<td>0.001</td>
<td>-0.061***</td>
<td>-0.070***</td>
<td>-0.113***</td>
</tr>
<tr>
<td>Constant -0.815***</td>
<td>0.240***</td>
<td>-1.136***</td>
<td>0.198***</td>
<td>-1.217***</td>
</tr>
<tr>
<td>Number of clusters 169</td>
<td>169</td>
<td>169</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>Cluster effect F1 12.967***</td>
<td>2.321**</td>
<td>12.161***</td>
<td>3.147***</td>
<td>9.906***</td>
</tr>
<tr>
<td>Observations 1869</td>
<td>1869</td>
<td>2017</td>
<td>1907</td>
<td>5793</td>
</tr>
<tr>
<td>R-squared 0.612</td>
<td>0.348</td>
<td>0.587</td>
<td>0.337</td>
<td>0.592</td>
</tr>
</tbody>
</table>

Source: Own calculation; ***p<0.01, **p<0.05, *p<0.1.

Cluster fixed effects confirm the existence of time and spatial variation (Deaton); SEs for both price and expenditure elasticity are calculated using bootstrap procedure of 1000 replications. Note: Tests showed the absence of statistically significant difference between price elasticities among all income groups: low-income and middle-income groups (χ²(1)=1.39, prob >χ²=0.2379); low-income and high-income groups (χ²(1)=1.48, prob >χ²=0.2239); middle-income and high-income groups (χ²(1)=0.40, prob >χ²=0.5276). Also, test showed the absence of statistically significant difference between income elasticities among all income groups: low-income and middle-income groups (χ²(1)=0.21, prob >χ²=0.6502); low-income and high-income groups (χ²(1)=1.04, prob >χ²=0.3078); low-income and high-income groups (χ²(1)=0.07, prob >χ²=0.7935).

Table 5 Total price and income elasticity

<table>
<thead>
<tr>
<th>Low-income households</th>
<th>Middle-income households</th>
<th>High-income households</th>
<th>All households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price -1.019***</td>
<td>-0.921***</td>
<td>-0.602***</td>
<td>-0.880***</td>
</tr>
<tr>
<td>Income 0.502***</td>
<td>0.496***</td>
<td>0.572***</td>
<td>0.530***</td>
</tr>
</tbody>
</table>

H0: No difference between income groups price elasticities

Li and Mi χ²(1)=1.53; prob >χ²=0.2168

Mi and Hi χ²(1)=10.27; prob >χ²=0.0014

Li and Hi χ²(1)=16.48; prob >χ²=0.0000

H0: No difference between income groups income elasticities

Li and Mi χ²(1)=0.19; prob >χ²=0.6653

Mi and Hi χ²(1)=0.19; prob >χ²=0.6667

Li and Hi χ²(1)=1.37; prob >χ²=0.2423

Li, Mi and Hi stand for low-income, middle-income and high-income households, respectively. SEs of price and income elasticities were estimated using a bootstrap of 1000 replications. Source: Own calculation; ***p<0.01, **p<0.05, *p<0.1.
tax burden by income group. The new consumption by income group was calculated as a product of baseline consumption and the sum of price and income effects. The price effect is defined as a product of the retail price percentage change and price elasticity, while the income effect represents a product of GDP growth and income elasticity. The total tax revenue was estimated by multiplying simulated consumption and total excise revenue.

The simulation scenario was created using the specific excise tax increase defined by the excise tax calendar in Montenegro—from EUR 0.6 to EUR 0.95 per pack of cigarettes. The ad valorem tax will decrease to 24.5% of the retail sales price. The results of the simulation by income groups are presented in Table 6.

The estimated impact of tax changes would make the tobacco tax system more progressive. While total consumption would decline by around 11.25%, with likely positive health effects, excise tax revenue collection would increase by 8.07%. From these results, it is evident that increasing excise taxes on cigarettes has a positive impact on changing patterns of consumption and public revenues generated from cigarettes taxes across each income group. Increases in excise taxes had the strongest reducing effect on the consumption of cigarettes among poor households (14.16%), while these changes produced the smallest reduction on excise revenue (increase for 4.53%). This result could be explained by the significantly higher price sensitivity of poor households relative to wealthier households. At the same time, the high-income group contributed the most to public revenues (12.97%).

Based on results, the planned policy would increase the progressivity of the tobacco tax system and could mostly benefit low-income and middle-income households. In this way, an increase in excise taxes may have a strong impact on the larger share of the population in Montenegro.

DISCUSSION

The main objective of this paper was to provide the first estimates of prevalence and intensity price and income elasticities among income groups, applying a two-part methodology. Moreover, the research provides simulations on the impact of tax policy changes on cigarette consumption and government revenues.

The estimates indicate that poor households are much more sensitive to price changes (price elasticity of −0.595) than the high-income group (price elasticity of −0.344). A similar conclusion may be drawn for the smoking intensity elasticity, based on elasticity magnitudes: the high-income group is less affected by changes in price, with a price elasticity of −0.258, compared with the low-income group, with a price elasticity of −0.424.

The fact that households in the low-income group spend a larger share of their budget on cigarettes is alarming, considering their income level. This is especially important in the context of poverty and growing disparities in health. However, taking into account the high prevalence of smoking and the higher total demand elasticity of this group, price-based measures, such as tax increases, can be an effective policy to reduce cigarette consumption, which would free up household resources for other, more beneficial spending.

We may conclude that increases in excise taxes to the EU minimum on tobacco would reduce cigarette consumption and, at the same time, maintain the collection of government revenues. The obtained simulation results confirm that price increases may generate a broader socio-economic impact. Total consumption decreased by 11.25%, and total government revenue from excise taxes increased by 8.07%. This is a significant decrease in smoking, which would have important positive results for public health.

Smoking results in higher healthcare costs, and spending on cigarettes has an impoverishing effect. Moreover, considering the high prevalence in the low-income group, it is important to reduce the harmful use of tobacco, applying price and non-price policies. An increase in cigarette taxes, especially through a specific tax, would significantly decrease the number of smokers and cigarette consumption while increasing excise tax revenues from cigarettes. In this way, initiation would be reduced while motivating cessation. Montenegro could benefit from the first scientific results of smoking prevalence and intensity elasticities by income groups and simulations on consumption and fiscal revenue changes as a crucial input for evidence-based policymaking, such as compliance with EU directives and the WHO Framework Convention on Tobacco Control.

Although it is common to use WAPC as a base for the simulation of the impact of excise tax on consumption and revenues (due to the unavailability of cigarette market prices in HBS database), it is still a limitation, which can cause the under/overestimation of simulated results. Future research needs to address the distributional impact of tobacco taxes in Montenegro. This analysis would provide estimates of the economic, health and social costs of tobacco consumption and the medium-term and long-term impacts of tobacco tax increases on curbing these costs.

CONCLUSION

The present study demonstrated that smoking prevalence and consumption in Montenegro are very responsive to price and income changes among all income groups. The increase of excise taxes, especially specific tax, would impact larger share of the population, mostly benefiting low-income and middle-income households. The simulation shows that taxation policy has a positive impact on changing consumption patterns across each income group, with the highest revenue collection coming from wealthier households.

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Table 6 Impact of price on consumption and government budget

| Income group | Share in total consumption | Consumption | | | Revenues | | |
|-------------|--------------------------|------------|--------|--------|--------|--------|
| | Baseline* | Scenario* | Change | Baseline | Scenario | Change |
| Low | 30% | 7 964 948 | 6 837 421 | −14.16% | € 10 115 485 | € 10 573 714 | 4.53% |
| Middle | 36% | 9 557 938 | 8 350 615 | −12.63% | € 12 138 581 | € 12 913 788 | 6.39% |
| High | 34% | 9 026 942 | 8 374 538 | −7.23% | € 11 464 216 | € 12 950 784 | 12.97% |
| Total | 100% | 26 549 828 | 23 562 574 | −11.25% | € 33 718 282 | € 36 438 286 | 8.07% |

Source: Own calculation.

*Pack; using GDP growth as an assumption for simulations means that all households are affected in the same way.
What this paper adds

What is already known on this topic

► Global evidence confirms that the tobacco taxation policy is one of the most effective tools to reduce smoking prevalence, specifically among the poor.
► Despite the overall high prevalence of tobacco use in Montenegro (40.7%) among adults, there is lack of scientific research of excise tax increases impact by socio-economic status on tobacco use and government revenues.

What this study adds

► Elasticity estimates showed that in Montenegro the poorest group is the most responsive to cigarettes price changes, which is especially important in the context of poverty and growing disparities in health.
► The obtained results confirm that specific tax increase of 58.3% may generate a broader socio-economic impact: total consumption decreased by 11.3%, and total government revenue from excise taxes increased by 8.1%.

How this study might affect research, practice or policy

► Montenegro could benefit from the first scientific results of smoking prevalence and intensity elasticities by income groups and simulations on consumption and fiscal revenue changes as a crucial input for evidence-based policymaking, such as compliance with EU directives and the WHO Framework Convention on Tobacco Control.

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Contributors

AM and MC contributed to developing ideas, data analysis and interpretation and wrote the first draft. TL and MK collected data, reviewed the existing empirical and theoretical evidence and made revisions. MC is the author responsible for the overall content as the guarantor.

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Disclaimer

The statements and conclusions expressed in this research are those of the authors and do not necessarily reflect those of the sponsors.

Competing interests

None declared.

Patient consent for publication

Not applicable.

Ethics approval

This study does not involve human participants.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data availability statement

Data are available in a public, open access repository. Data may be obtained from a third party and are not publicly available. Data is obtained from a third party and is not publicly available. The research uses Household Budget Survey data obtained from the Statistical Office of Montenegro. The data is related to individual data on households, which is not publicly available and cannot be shared. For this purpose, the contract on confidentiality was signed with Montenegrin Statistical Office (No 01-3508/2) on 31 July 2018. Data for cigarette consumption are obtained from Ministry of Finance internal reports, which are not publicly available and cannot be shared.

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