Accelerating progress on effective tobacco tax policies in Montenegro

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ABSTRACT

Background The objective of this study is to estimate the sensitivity of cigarette quantity demanded to price and income changes in Montenegro.

Data and methods The sensitivity of cigarette quantity demanded to price and income changes was estimated using micro and macro analysis. Micro analysis implied the use of Deaton's model on Household Budget Survey data (2006–2017). In macro analysis, conventional static demand model is applied using error correction and autoregressive distributed lag time series methodology on annual time series aggregated data (2001–2017).

Results The same results were obtained using micro and macro analysis which contributes to the objectivity of the conducted research. Results derived from the Deaton's model indicate a negative price elasticity of cigarettes in the range between −0.62 and −0.80 (conditional and unconditional), while in macro model estimated price elasticity is in that range and equals −0.68. Simulation results confirm the efficiency of excise tax policy changes, having an evident decrease in consumption and increase of public revenues.

Conclusion Analysis of the tobacco market and regulatory environment suggests that the increase of excise and other taxes on tobacco have an important direct impact on the reduction of cigarettes and other tobacco products consumption. Our estimates of long and short-run price elasticity show that direct impact is strong and very much in accordance with the results obtained so far for other low-income and middle-income countries. This paper gives a contribution to the analysis of price elasticity of demand for cigarettes, which was for the first time conducted in Montenegro.

INTRODUCTION

The prevalence of smoking in Montenegro is high, with an increasing trend in the recent period. Results from Montenegrin Institute of Public Health,[1] given in table 1, show a decreasing trend of smoking prevalence in the adult population from years 2000 to 2012, while increasing afterward. The increase is mostly due to the female smoking rates increase in 2017 compared to 2012, having a stable trend of male prevalence in the same period.[1] Results from various sources and research[1–6] showed an increasing trend of smokers in youth population in Montenegro, also particularly among females.

Total legal consumption (table 1), which is calculated based on used excise stamps, shows decreasing trend from 2000 to 2017 (78% decrease; data obtained from Montenegrin Ministry of Finance). The possible reasons for higher smoking rates in 2017 compared to 2012, while having a decreasing trend of legal consumption at the same time, could be potentially in cross-border transactions and illicit trade. Additional reason could be that consumers may smoke fewer cigarettes, even if number of smokers is increasing.

The Government of Montenegro, as a signatory to the WHO Framework Convention on Tobacco Control (WHO FCTC),[7 8] encourages the reduction of tobacco use through a set of smoking control measures. All relevant legislation,[8–15] as well as strategies, was adopted. The tobacco tax structure includes a specific tax that currently amounts €30 on 1000 cigarettes and an ad valorem tax of 32% of the weighted average price of cigarettes (WAPC). Montenegro is aiming to fulfil the European Union (EU) Directives[16 17] and excise tax requirements are partially in line with the Council Directive 2011/64/EU. WAPC in 2018 amounted €2.10 compared to the European Union average of €4.80 in the same year, while minimal excise per pack of cigarettes was €1.27 comparing to European Union directive of €1.80. Even though the European Union levels are not still being fulfilled, the excise tax increase was followed by decreasing trend of consumption, and increasing trend of public revenues share in Gross Domestic Product (GDP) collected from tobacco, from 0.70% to 1.70%.[18]

The objective of this study is to give the first estimates of the sensitivity of cigarette demand to price and income changes, by applying micro and macro analysis. Moreover, the goal is to verify the suitability of the methods applied, Deaton's[19 20] and time series, in case of limited availability of data, especially market price. The data related to cigarettes consumption is derived from the Household Budget Survey (HBS), covering a longer period, which allows us to apply Deaton's methodology. Even though there are no available longer time series aggregated data on consumption and prices of cigarettes, times series methodology was applied, as it represents the most widely applied methodology in low-income and middle-income countries (LMICs). This methodology is also applied with the aim to check robustness of micro analysis. Additionally, the study will provide simulation effects of an excise tax increase on consumption and public revenues, using estimated price elasticities.

Generally, the results of studies in LMICs, found price elasticity estimates ranging between 0 and −1, depending on methodology applied.[21 22] Deaton's model in LMICs is mostly used on HBS data: Asia,[23–28] Africa[29 30] Latin America.[31 32] Most of these researches were done from 2000 onwards. Some studies in LMICs use sample of households with positive cigarettes purchases, or estimate conditional price elasticities in range between −0.20 and −0.60.[23 29] On the other hand, others use the

Table 1 Consumption and prevalence trend (2000–2017)

Year	Total legal consumption	Prevalence		
		Adult	Male	Female
2000	127.1	43.8	52.4	36
2008	108.1	32.7	35.9	29
2012	53.8	31	35	27
2017	28.5	35.4	36.2	34.5

Institute of Public Health conducted only four Surveys: years 2000, 2008, 2012 and 2017.
Data for consumption obtained from Ministry of Finance, given according to available prevalence time series.

whole sample, including households with zero purchases, or estimate unconditional elasticities in range between –0.50 and –1.30.[24 25 27 28 30 32] To the best of our knowledge, there is a lack of research using Deaton's method in LMICs in Western Balkan, as well as in Eastern Europe.

If we summarise results of a number of studies in LMICs from 2000 and onwards, which use time series methodology,[21 31 33–38] we conclude that they are in line with estimated elasticities using Deaton's method, being in the range between –0.20 and –0.80.

This paper contributes to the existing literature of the analysis of price effects on cigarettes consumption and public revenues, providing conditional and unconditional estimates of price and income elasticities for the first time in Montenegro. Being the first scientific research of this kind, the simulations on consumption and public revenues can be used as a crucial input for evidence-based policy-making, such as legislative changes and compliance with European Union directives. This fact is even more important, taking into consideration that Montenegro, in its region, has the highest adult's prevalence of tobacco smoking, according to WHO estimates.[6] Due to previously mentioned, our research represents the inception phase for further research related to tobacco prevalence and diverse health effects.

DATA AND METHODS

In micro analysis, we use HBS data from 2006 to 2017 (excluding 2016 when Survey was not conducted), collected by the Statistical Office of Montenegro.[39] HBS is the national annual survey which provides data for average households' expenditure and consumption size and structure. Households are surveyed during 1 month per year which means that each household is surveyed only once a year. This survey covers 21 municipalities in three regions in Montenegro—North, Central and South. The database for each year provides detailed characteristics on households, comprising of socio-economic and demographic features (on average 1202 households surveyed annually). There are 12 503 households in the whole sample and 5775 households with positive consumption or 46.33% of the whole sample, after removing outliers. Even though the price effect may trigger the transition from cigarettes to other tobacco products, we have excluded households who report spending on other tobacco products, having a negligible share—only 3.59%.

Deaton's model,[19 20] applied in micro analysis, is a model of consumer behaviour in which households within a specific cluster choose products and spend the budget on a product depending on its price, quantity and quality. Using this model, a system of demand equations for deriving own and cross-price elasticities can be estimated, based on expenditure and quantity data from household surveys. The model defines a proxy for cigarette prices, or unit value, as a ratio of cigarette expenditures and quantity. However, it is important to point out that this ratio is only unit value, not price. The reason is found in the fact that unit value, besides information about the price, also reflects the choice of quality (quality shading) and possible measurement error. Quality shading means that consumers could retain the same level of consumption, switching to cheaper brands, due to price increase. Considering the relationship of harmfulness, price and quality of cigarettes, all cigarettes are considered to be harmful and while there may be very minor differences in how harmful, this is captured by the Deaton model as part of how it deals with differences in prices and quality. On the other hand, measurement error refers to misreport expenditure of goods purchased. This is why Deaton's model proposes a methodology on how to correct the final estimation of price elasticity for quality shading and measurement error. Additionally, the model assumes that unit values vary spatially between clusters, but not within the cluster. In order to capture the effect of the spatial price variation, the households in the sample must be geographically clustered.

The unit values are expressed in euro per cigarette pack. Moreover, the model includes a variable budget share which is calculated as a ratio of monthly household expenditure on cigarettes and the total monthly household expenditure.

The model relies on two equations[19 20]:

$$w_{ic} = \alpha^0 + \beta^0 lnx_{ic} + \gamma^0 . z_{ic} + \theta lnp_c + u_{ic}^0 \quad (1)$$

$$lnv_{ic} = \alpha^1 + \beta^1 lnx_{ic} + \gamma^1 . z_{ic} + \psi lnp_c + u_{ic}^1 \quad (2)$$

The dependent variables in (1) and (2) are budget share and unit value, respectively, both household i in the cluster c. We define clusters c based on the information on municipalities and years, that is, the cluster is defined as a municipality x in the year t. The independent variables are: lnx_{ic} is the logarithm of total household expenditure; z_{ic} is the vector of household socio-economic characteristics (household size, adult ratio, male ratio, maximum and mean of years of education and household type by activity); lnp_c is the logarithm of prices; u_{ic} is the idiosyncratic error.

Real values for budget share, unit value and all expenditure variables were constructed using annual Consumer Price Index (CPI) for the period 2006–2017.[18] Regression beta coefficient β^1 of variable lnx_{ic} in the unit value equation represents expenditure elasticity of quality which measures choice of quality due to changes in the household's wealth. The degree of unit value change due to 1 unit change in prices is represented by the coefficient ψ. Using the information on the quality effects magnitude (β^1), it is possible to correct final price elasticity for quality shading. In case of no variations due to the product's quality, the change of unit value would reflect only the changes in price ($\beta^1 \to 0$, $\psi = 1$). The model consists of three stages. In the first stage, the effects of household socio-economic characteristics are removed from both dependent variables, so that estimation of price elasticity in the second stage is not influenced by these characteristics (ie, purging quality effects). In the second stage, cluster averages of budget shares and unit values are generated. Finally, in the third stage the weak separability assumption is introduced, as to separate the price and quality effects within the unit value.

According to Deaton,[19 20] demand model formulation depends on whether we want to model demand conditional on making purchases, or whether unconditional with consumers and non-consumers covered. Some previous empirical research in LMICs[23 40] confirmed that spending decisions of households with zero consumption do not depend on cigarette prices. Still,

considering that there is no evidence for Montenegro that cigarettes do not exist in non-consumers utility function, no matter what the price is, we decided to estimate both conditional and unconditional elasticity. In that manner, we can estimate excise tax impact on consumption of consumers, as well as on the whole sample, because some non-consumers may begin to consume tobacco products when the price decreases.

In the macro analysis, we used annual time series aggregate data on cigarette consumption, cigarette prices, income and public policies from 2001 to 2017. We estimated cigarette demand function using a conventional static demand model, presented in linear functional form. According to the time-series properties of data, the Engle-Granger two-step method was applied.[41] In the first step we estimated long-run price elasticity by employing the following linear functional form of cigarette demand:

$$Y_t = \alpha + \beta_0 P_t + \beta_1 I_t + \beta_2 R_t + u_t \quad (3)$$

where the dependent variable Y_t is legal cigarette consumption per adult population. Y_t was calculated by multiplying the number of used excise stamps by number of cigarettes in one pack (20 cigarettes) and divided by the total number of adults (15+).[18] The obtained data of used excise stamps was the only available data on legal cigarettes consumption. However, taking into account that industry may take advantage of frontloading, there is a possibility that this quantity does not completely correspond to the real consumption. Having regard to still low price and high availability of cigarettes in Montenegro, we may assume that the deviations of legal consumption from the real values are not high.

Independent variables comprised:

- Cigarette prices (P_t) approximated by real tobacco CPI[18]—tobacco CPI divided with general CPI.
- Income (I_t) approximated by GDP per capita in constant prices.[42]
- A single regulatory variable (R_t) comprising of Law on Limiting Use of Tobacco Products amendments[14] introduced at once in 2011 (stricter bans of tobacco advertising, sponsorship, marketing, selling and promotion, as well as on tobacco use in public spaces).

Tested impact on consumption of other regulatory changes, covering all tobacco control laws and strategies was not statistically significant. Due to estimation problems (multicollinearity, endogeneity), other control variables (enrolment in tertiary education, employment and unemployment percentage, male to female ratio, survival to age 65 for male and female) were not included. In the second step of the Engle-Granger method—error correction model (ECM), we used the first-differenced variables and lagged residuals from the first step to estimate the short-run price elasticity of cigarette quantity demanded. We checked the sensitivity of the results using an alternative estimating methodology in cointegration framework - autoregressive distributed lag (ARDL).

RESULTS

Estimation of the price elasticity using micro data

Table 2 summarises the results of regression analysis related to unit values and budget shares regional and time variations. These variations are significant in case of both variables. The exception is the consumers' budget share in the period 2011–2015. In both samples, the budget share has a decreasing trend, while we can notice an increasing trend of the average price of cigarettes per pack during the period observed. The reason for the budget share decrease is the higher growth rate of total expenditure comparing to the growth rate of expenses on cigarettes. Decrease of budget share could also be explained by the decrease of the quantity purchased or substitute to cheaper quality due to price increase.

The results from the regression are expected, showing the lowest prices per pack paid by household in the North region, being the least developed region in Montenegro. The prices in South and Centre are approximately the same. On the other hand, even though the North region is the least developed, the households spend a larger share of the available budget

Table 2 Regional and time variation of cigarettes unit values and budget shares

	Unit value		Cigarettes		Cigarettes	
Cigarettes	(Per cigarette pack)	SE	Budget share—consumers	SE	Budget share—whole sample	SE
Region	Centre		Centre		Centre	
North	−0.082***	−0.009	0.007***	−0.001	−0.004***	(0.001)
South	0.040***	−0.004	−0.004***	0.000	−0.011***	(0.001)
Year 2007	−0.031*	−0.017	−0.014***	−0.002	−0.008***	(0.001)
2008	−0.034**	−0.016	−0.015***	−0.002	−0.008***	(0.001)
2009	0.067***	−0.016	−0.008***	−0.002	−0.005***	(0.001)
2010	0.105***	−0.017	−0.009***	−0.002	−0.009***	(0.001)
2011	0.261***	−0.017	−0.003	−0.002	−0.007***	(0.001)
2012	0.412***	−0.017	0.000	−0.002	−0.005***	(0.001)
2013	0.493***	−0.017	0.003	−0.002	−0.005***	(0.001)
2014	0.560***	−0.017	0.002	−0.002	−0.005***	(0.001)
2015	0.526***	−0.017	0.003	−0.002	−0.006***	(0.001)
2017	0.518***	−0.025	−0.010***	−0.003	−0.012***	(0.002)
Constant	0.763***	−0.012	0.051***	−0.001	0.030***	(0.001)
Observations	5793		5793		12503	
R-squared	0.422		0.054		0.019	
F	351.4		27.5		19.87	
r2_a	0.421		0.052		0.018	

SEs in parentheses: ***p<0.01, **p<0.05, *p<0.1.
Author's calculation based on the Household Budget Survey data.

Table 3 Descriptive statistics of variables used in the first-stage regression

	Observations	Mean	SD	Min	Max
Consumers					
Unit value, cigarettes	5775	0.993	0.380	0.312	2.472
Budget share, cigarettes	5775	0.046	0.037	0.000	0.496
Total expenditure	5775	756.128	389.698	63.988	2900.703
Household size	5775	3.497	1.831	1.000	56.000
Male ratio*	5775	0.505	0.245	0.000	1.000
Adult ratio*	5775	0.881	0.189	0.250	1.000
Mean of years of education	5775	10.676	1.766	0.000	20.000
Maximum education	5775	14.132	2.546	0.000	20.000
Household type*					
Unemployed	5775	0.035	0.185	0.000	1.000
Pensioners	5775	0.192	0.394	0.000	1.000
Employed	5775	0.772	0.419	0.000	1.000
Whole sample					
Unit value, cigarettes (ln)	5775	0.993	0.380	0.312	2.472
Budget share, cigarettes	12 503	0.021	0.034	0.000	0.496
Total expenditure (ln)	12 503	689.281	387.071	33.687	2630.04
Household size (ln)	12 503	3.206	1.792	1.000	56.000
Male ratio*	12 503	0.464	0.271	0.000	1.000
Adult ratio*	12 503	0.889	0.188	0.200	1.000
Mean of years of education	12 503	10.062	2.884	0.000	20.000
Maximum education	12 503	11.924	3.159	0.000	20.000
Household type*					
Unemployed	12 503	0.034	0.181	0.000	1.000
Pensioners	12 503	0.250	0.433	0.000	1.000
Employed	12 503	0.716	0.451	0.000	1.000

Author's calculation based on the Household Budget Survey data.
T statistics difference between variables means: budget share t=−94.733121; total expenditure t=−17.645353; household size t=−16.984248; male ratio t=−16.344199; adult ratio t=4.2696627; mean education t=−5.2837905; max education=−10.555047; employed t=−0.79802037; pensioners t=14.127229 and unemployed t=−13.193474.
*Adult ratio represents percentage of adults in household, including members aged 15 or more. Male ratio represents percentage of males in household. We controlled for the household economic activity by splitting households into three groups: (1) unemployed (each member unemployed), (2) pensioners (no employees, only pensioners), (3) employed (at least one member employed- person in paid employment).

on cigarettes compared to other two regions, which was also confirmed in previous research.[27 43 44]

Descriptive statistics of variables used in the first stage regression is given in table 3. According to t statistics, there is a statistically significant difference between variables means of consumers and the whole sample. Results of both samples indicate almost equal representation of man and woman in households, while adults represent 88% of the household members. The majority of households' members have a secondary level of education, while on average 3% of households are 'unemployed', 19% to 25% are 'pensioners', and more than 70% 'employed'. The lower budget share in the whole sample is expected, 2.10% compared to 4.60% in the sample of consumers.

First stage: household level regression

Summary of the first stage regression results is presented in table 4.

The expenditure elasticity of quality amounts 0.22, indicating that quality effects are present in unit value data. With 10% higher total expenditure, the households tend to buy cigarettes that are 2.22% more expensive, controlling for other socio-demographic variables. Considering that these results confirm quality shading in Montenegro, the use of Deaton's model is appropriate, as it enables control for quality effects. When it comes to influencing of total expenditure on cigarettes budget share, the 10% higher total expenditure will lead to a decrease of 0.25% (consumers) or 0.04% (whole sample) share of budget spent on cigarettes.

Based on the sign and the value of other socio-demographic variables, we can conclude that larger households, households with more men and elderly members pay lower prices. Pensioners and unemployed households pay less for cigarettes, compared to employed. Households with more men and adults spend a larger share of the budget on cigarettes. Cluster fixed effects confirm the existence of time and spatial variation.

Based on the results from the first stage regression, we generate the results of the total expenditure elasticity of demand which

Table 4 First-stage regression results

	Unit value		Cigarettes		Cigarettes	
Variables	**(Per pack)**	**SE**	**Budget share—consumers**	**SE**	**Budget share—whole sample**	**SE**
Total expenditure (ln)	0.222***	−0.009	−0.025***	−0.001	−0.004***	(0.001)
Household size (ln)	−0.109***	−0.009	−0.002**	−0.001	0.001	(0.001)
Male ratio	−0.036**	−0.015	0.013***	−0.002	0.017***	(0.001)
Adult ratio	−0.133***	−0.022	0.010***	−0.003	0.010***	(0.002)
Mean of years of education	0.003	−0.002	−0.001***	0.000	0.000	(0.000)
Maximum education	0.001	−0.002	0.000	0.000	−0.000	(0.000)
Household type						
Employed—omitted						
Unemployed	−0.059***	−0.021	−0.001	−0.002	0.002	0.0017
Pensioners	−0.090***	−0.011	−0.005***	−0.001	−0.006**	0.000
Cluster dummies	F(192,5573)		F(192,5573)		F(200,12294)	
	28.425***		5.748***		5.237***	
Constant	−1.311***	−0.064	0.203***	−0.008	0.034***	(0.005)
Observations	5775		5775		12 503	
R-squared	0.574		0.289		0.104	
F	107.9		116.6		44.02	
r2_a	0.558		0.263		0.088	

SEs in parentheses: ***p<0.01, **p<0.05, *p<0.1.
Author's calculation is based on the Household Budget Survey data. Households were grouped in 209 clusters which on average included 59 households.

is positive and amounts 0.23 (conditional) and 0.63 (unconditional). More precisely, 10% higher total expenditure of household will lead to 2.30% (conditional) or 6.30% (unconditional) higher demand for cigarettes.

Second stage: cluster level estimates

In the second stage regression, the analysis additionally purged the regional effects, due to differences between the regions (North, Centre and South) in the level of development, which could influence consumer preferences. Results of the estimation indicate a negative price elasticity of cigarettes, which amounts −0.62 (conditional) and −0.80 (unconditional). SE of the elasticity calculated via bootstrapping procedure (1.000 replications) indicates that the elasticity is significantly lower than zero (ϵ_c= -0.62; SEϵ=0.11, t=−5.53; ϵ_{uc}= -0.80; SEϵ=0.13, t=−6.27). These results are in line with previous relevant scientific research done applying Deaton's model on HBS data[23–32] which showed that the price elasticity of the demand in LMICs varies from −0.2 to −0.6 (conditional) and −0.5 to – 1.3 (unconditional).

Estimation of the price elasticity using macro data

Examination of time-series properties of data showed that all variables presented in equation 3 are non-stationary at the level, stationary at the first difference, cointegrated and that price exogeneity cannot be rejected which allow us to use the Engle-Granger two-step methodology.[41] From regulatory framework point of view, variable that represents changes in tobacco control regulation from 2011,[14] was negative, suggesting that these changes had a negative impact on cigarette consumption. Price coefficient was also negative, as it was expected. We derived long-run and short-run price elasticities using estimated price coefficients in the first and the second step of the Engle-Granger method. Our model passed all post-diagnostic and specification test implemented, and the results along with estimated elasticities in table 5.

Significant coefficient of lagged residuals, given in table 5, indicates that after a short-run response to a change, consumption monotonically converges back towards its long-run equilibrium. This adjustment parameter amounts to −0.52, that is, 52% of deviation from the equilibrium value is eliminated in the following year. If we consider the bootstrapped values, we can conclude that a 10% increase in price will lead to a 6.84% decline in cigarette quantity demanded in the long-run. After checking the stability of price elasticity using an alternative methodology ARDL, we can conclude that the ECM estimated the price elasticity of −0.68 is reliable, as it is close to ARDL estimate of −0.64. Estimated price elasticity in the short-run is –0.46. These results are confirmed in previous relevant scientific research, pointing out that the price elasticity of the demand in LMICs varies from −0.20 to −0.80[21 31 33–38]

Table 5 Price elasticity estimates

Price elasticity	
Long-run price elasticity	**−0.717*** **
Long-run bootstrapped price elasticity* (500 replication)	**−0.684 (±0.017)*** **
Short-run price elasticity	**−0.465** **
Coefficient on lagged residual	**−0.518** **
Post diagnostic tests	
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	$\chi2(1)=1.53$; Prob>$\chi2=0.2156$
Durbin's alternative test for autocorrelation	Prob>$\chi2=0.577$; $\chi2(1)=0.447$; Lags 1
Ramsey Regression Equation Specification Error Test (RESET) test	F(3, 9)=3.41; Prob>F = 0.0734
Jarque-Bera normality test	Chi(2)=0.6319; Prob>$\chi2=0.7291$
Mean Variance inflation factor (VIF)	1.31

SEs in parentheses: ***p<0.01, **p<0.05, *p<0.1.
*Bootstrapped SE using 1000 replications for long run price elasticity is given in bracket.

Tobacco tax simulation model: the impact of tax changes on public revenues and consumption

Simulation is based on a realistic assumption that supply function is perfectly elastic and that consequently, the whole tax burden is on the consumers. Even if this assumption is not totally realistic, its conclusions regarding the impact of excise on public revenue and cigarette consumption are the same. In simulations, we use estimated conditional and unconditional price and income elasticities from micro model, due to the more representative sample compared to macro. The simulation of consumption and public revenues change due to the excise taxes increase comprises of two scenarios, made according to Montenegro's excise taxes timetable. Consumption is calculated multiplying baseline consumption (1 000 000 cigarettes) with the sum of price and income effect. Price effect is derived from the product of the retail price percentage change and price elasticity (conditional −0.62 and unconditional −0.80) while income effect is defined as a product of GDP growth (3.5%) and income elasticity (0.23 and 0.63). Total excise revenue was estimated as a product of total excise tax and changed consumption. Total tax revenue from cigarettes was obtained by summing up Value Added Tax (VAT) and total excise revenue. The scenarios results are given in table 6.

Simulation results of both scenarios confirm the positive effects of excise tax policy changes, having inelastic demand: consumption is decreasing, while public revenues increase. These results compare favourably with estimates in other LMICs.[22 26–28 33 44 45]

Conclusions and discussion

The main objective of this paper was to provide the first estimates of conditional and unconditional price and income elasticity of cigarettes quantity demanded in Montenegro. Additionally, the goal was to verify the suitability of the methods applied, Deaton and time series, in case of limited data, especially price. Results of the estimation indicate a price and income elasticity of cigarettes ranging from −0.62 to –0.80 and 0.23 and 0.63, respectively, depending on the methodology and sample used. These results are comparable with the international evidence in LMICs. According to the simulation results, an increase in tobacco excise taxes would lead to a decrease in tobacco products consumption. Depending on the applied policy scenario and dynamics of the excise tax increase, the increase of prices would positively impact not only population health but also the fiscal situation. Additionally, the impact could be even greater in the case of faster and more dynamic increases in tobacco excise taxes. In that manner, the revenues from excise taxes increases could be invested in health programme. Moreover, the change in price could reduce the overall adults and youth prevalence and decrease direct healthcare costs and number of patients.

As the increase in the standard of living could potentially neutralise the effects of tobacco tax increases, the importance of other instruments for tobacco consumption reduction has to be more emphasised. Even tough non-price measures such as anti-tobacco campaigns and other defined in WHO FCTC[7] are recognised by Montenegrin regulatory framework, they need to be more efficiently implemented. This process, along with stricter tobacco market control, would be feasible through synergy and

Table 6 Impact of price and excise tax increase on consumption and government budget

	Conditional price elasticity		Unconditional price elasticity	
Scenario	Cigarettes consumption	Total government revenue	Cigarettes consumption	Total government revenue
I*	−7.00%	8.00%	−7.66%	6.92%
II†	−14.00%	12.35%	−16.93%	8.35%

Baseline assumptions: cigarette consumption 1 000 000; conditional price and income elasticity −0.62 and 0.232; unconditional price and income elasticity −0.80 and 0.63; GDP growth rate 3.5%; specific excise €0.6 per pack, ad valorem 32%, VAT 21% (2018); retail price 2.1 (WAPC 2018).
*Specific excise increases from €0.6 to €0.8, ad-valorem excise taxes increase by 2%.
†Specific excise increases from €0.8 to €1, ad-valorem excise taxes increase by 2%.
WAPC, weighted average price of cigarettes.

widened dialogue between various stakeholders. Definitely, the increasing prevalence sets the alarm for immediate changes.

The policy-makers in Montenegro could benefit from the very first scientific results of conditional and unconditional elasticity and simulations on consumption and public revenues as a crucial input for evidence-based policy.

Potential limitations of the study could be found in the unavailability of a longer time series of price and consumption in macro model, which does not contain the data of illicit trade. Considering that industry may take advantage of front-loading, there is a possibility that consumption variable from macro model does not completely correspond to the real legal consumption. However, the macro model limitations are mostly neutralised through micro model, due to larger sample and data which covers illicit market (the surveyed households reported each purchase regardless of the point of sale—legal or illegal). Due to unavailability of data, the effect of switching to cheaper brands when price increases was not taken into account. This aspect is very important, as the brand substitution could potentially, in some extent, decrease the price elasticity coefficient.[46 47] The future research needs to address youth cigarettes consumption and the issues of these products availability within this population.

What this paper adds

- While much is known about the smoking's negative impact on health and increasing prevalence in the Western Balkans region, there is no evidence about the impact of excise taxes increase on consumption in Montenegro. This is the first paper which estimates the sensitivity of cigarette quantity demanded to price and income changes in Montenegro. Based on macro and micro (Household Budget Survey) analysis, the research provides relevant and objective results considering the impact of tobacco taxation and control policies on cigarettes consumption.
- Policies implying faster and more dynamic increases in tobacco excise taxes could positively impact the overall prevalence of adults and youth, by reducing prevalence rate and decreasing direct healthcare costs and number of patients. Additionally, there would be an evident and strong positive impact on public revenues.

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REFERENCES

1 Institute of Public Health. Study of quality of life, life styles and health risks in Montenegro, 2017. Available: http://www.ijzcg.me/wp-content/uploads/2018/03/ISTRAZIVANJE-O-KVALITETU-ZIVOTA-ZIVOTNIM-STILOVIMA-I-ZDRAVSTVENIM-RIZICIMA-STANOVNIKA-CG-U-2017.-GODINI.pdf [Accessed 5 July 2018].
2 ESPAD Report. Substance use among students in 36 European countries, 2011. Available: http://www.espad.org/sites/espad.org/files/The_2011_ESPAD_Report_FULL_2012_10_29.pdf; [Accessed 5 July 2018].
3 ESPAD Report. Results from the European school survey project on alcohol and other drugs, 2015. Available: http://www.espad.org/sites/espad.org/files/ESPAD_report_2015.pdf [Accessed 5 July 2018].
4 Institute of public health global youth tobacco survey – GYTS, 2004, 2008, 2014. Available: https://nccd.cdc.gov/GTSSDataSurveyResources/Ancillary/DataReports.aspx?CAID=1 [Accessed 5 July 2018].
5 Mugoša B, Đurišić T, Golubović L. ESPAD national report. Institute of public health Montenegro, 2008. Available: http://www.espad.org/content/espad-national-report-2008 [Accessed 5 July 2018].
6 World Health Organization. Age-standardized prevalence of tobacco smoking among persons 15 years and older, by who region, 2016. Available: http://apps.who.int/gho/data/node.sdg.3-a-viz?lang=en [Accessed 28 May 2018].
7 World Health Organization. Framework convention on tobacco control, 2003. Available: http://apps.who.int/iris/bitstream/handle/10665/42811/9241591013.pdf;jsessionid=6BE3093ACCBEF7E84498A826D2B2826B?sequence=1 [Accessed 28 May 2018].
8 Law on Ratification of the framework convention of the world health organisation on tobacco control with annexes, official Gazette of Serbia and Montenegro-International Treaties, P.L.No. 16/05.
9 Law on excises Tax, official Gazette of Republic Montenegro, P.L.No. 065/01, 012/02, 076/05 and official Gazette of Montenegro P.L.No. 076/08, 050/09, 078/10, 040/11, 061/11, 028/12, 038/13, 045/14 008/15, 001/17, 50/17, 55/18.
10 Law on fees for access to services of general interest and for the use of tobacco products, electric –Acoustic and acoustic devices, official Gazette of Montenegro, P.L.No. 028/12, 62/13, 9/15.
11 Law on fees for the use of tobacco products, Electric- acoustic and acoustic devices, official Gazette of Montenegro, P.L.No. 37/17.
12 Ministry of Health. Available: http://mzdravlja.gov.me/en/library?alphabet=lat
13 Law of tobacco, official Gazette of the Republic of Montenegro, P.L.No. 80/04, 005/05 and official Gazette of Montenegro, P.L.No. 48/08, 76/08, 40/11, 42/15.
14 Law on limiting use of tobacco products, official Gazette of the Republic of Montenegro, P.L.No. 052/04 and official Gazette of Montenegro, P.L.No. 032/11, 047/11, 003/16.

15 Law on Ratification of the protocol to eliminate illicit trade in tobacco products, official Gazette Montenegro 5/17.
16 Council Directive 2011/64/EU of 21 June 2011 on the structure and rates of excise duty applied to manufactured tobacco. Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:176:0024:0036:EN:PDF [Accessed 12 April 2018].
17 European Parliament and Council Directive 2014/40/EU on the approximation of the laws, regulations and administrative provisions of the member states concerning the manufacture, presentation and sale of tobacco and related products and repealing Directive 2001/37/EC. official Journal of EU, no. L127/1, 2014. Available: https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:32014L0040 [Accessed 12 April 2018].
18 Statistical Office of Montenegro - MONSTAT. Statistical Yearbook of Montenegro for: 1997, 2003, 2004, 2006, 2008, 2010, 2013, 2015, 2017. Available: https://www.monstat.org/eng/publikacije.php [Accessed 15 Mar 2018].
19 Deaton A. An almost ideal demand system. *Am Econ Rev* 1980;70:312–26.
20 Deaton A. Quality, quantity, and spatial variation of price. *American Economic Review* 1988;78:418–30.
21 U.S. National Cancer Institute and World Health Organization. The economics of tobacco and tobacco control. National cancer Institute tobacco control monograph 21. NIH publication No. 16-CA-8029A. Bethesda, MD: U.S. department of health and human services, National Institutes of health, National cancer Institute; and Geneva, CH: World Health organization, 2016. Available: https://cancercontrol.cancer.gov/brp/tcrb/monographs/21/docs/m21_complete.pdf [Accessed 15 July 2018].
22 International Agency for Research on Cancer. IARC handbooks of cancer prevention in tobacco control: effectiveness of Tax and price policies for tobacco control. vol.14. Lyon, France, 2011. Available: http://www.iarc.fr/en/publications/pdfs-online/prev/handbook14/handbook14.pdf [Accessed 1 June 2018].
23 John RM. Price elasticity estimates for tobacco products in India. *Health Policy Plan* 2008;23:200–9.
24 Guindon GE, Nandi A, Chaloupka FJ, *et al*. Socioeconomic differences in the impact of smoking tobacco and alcohol prices on smoking in India. *Nati Bur Econ Res Work Pap Ser* 2011;17580:1–36.
25 Eozenu P, Fishburn B. Price elasticity estimates for cigarette demand in Vietnam. development and policies research center (DEPOCEN), working paper series No. 2009/05.
26 Salti N, Chaaban J, Nakkash R, *et al*. The effect of taxation on tobacco consumption and public revenues in Lebanon. *Tob Control* 2015;24:77–81.
27 Nayab D, Nasir M, Memon J, *et al*. Economics of tobacco taxation and consumption in Pakistan. Pakistan Institute of development economics Islamabad, 2018. Available: https://pide.org.pk/Research/Economics-of-Tobacco.pdf [Accessed 12 Dec 2018].
28 Chen Y, Xing W. Quantity, quality, and regional price variation of cigarettes: demand analysis based on a household survey in China. *China Economic Review* 2011;22:221–32.
29 Chelwa G, van Walbeek C. Does cigarette demand respond to price increases in Uganda? Price elasticity estimates using the Uganda National Panel Survey and Deaton's method. *BMJ Open* 2019;9:e026150.
30 Nassar H. Economics of tobacco in Egypt: a new analysis of demand. HNP discussion papers. economics of tobacco control paper; No. 8 2003.
31 Gonzalez-Rozada M, Ramos-Carbajales A. Implications of raising cigarette excise taxes in Peru. *Rev Panam Salud Publica* 2016;40:250–5.
32 Chávez R. Price elasticity of demand for cigarettes and alcohol in Ecuador, based on household data. *Rev Panam Salud Publica* 2016;40:222–8.
33 Szabó A, Lázár E, Burián H, *et al*. *The economics of tobacco and tobacco taxation in Romania*. Tîrgu Mureş, Romania: University of Medicine and Pharmacy of Tîrgu Mureş, 2016: 1–56.
34 Ross H, Stoklosa M, Krasovsky K. Economic and public health impact of 2007–2010 tobacco Tax increases in Ukraine. *Tob Control* 2012;21:429–35.
35 Ross H, Al-Sadat NAM. Demand analysis of tobacco consumption in Malaysia. *Nicotine Tob Res* 2007;9:1163–9.
36 Mushtaq N, Mushtaq S, Beebe LA. Economics of tobacco control in Pakistan: estimating elasticities of cigarette demand. *Tob Control* 2011;20:431–5.
37 Ramos-Carbajales A, González-Rozada M, Vallarino H. La demanda de cigarrillos Y El aumento de impuestos en El Salvador. *Rev Panam Salud Publica* 2016;40:237–42.
38 Martinez E, Mejia R, Pérez-Stable EJ. An empirical analysis of cigarette demand in Argentina. *Tob Control* 2015;24:89–93.
39 Statistical Office of Montenegro - Monstat. *Household budget survey 2006-2015 and 2017*.
40 Farrelly MC, Bray JW, Pechacek T, *et al*. Response by adults to increases in cigarette prices by sociodemographic characteristics. *South Econ J* 2001;68:156–65.
41 Engle RF, Granger CWJ. Co-integration and error correction: representation, estimation, and testing. *Econometrica* 1987;55:251–76.
42 IMF. World economic outlook database 2001-2017. Available: https://www.imf.org/en/publications/weo [Accessed 28 May 2018].
43 Fuchs A, Meneses F. Tobacco Price Elasticity and Tax Progressivity in Moldova. Policy Research Working Paper;No 8327. World Bank Group, Washington. 2018:1-19. Available: http://hdl.handle.net/10986/29315 [Accessed 15 Sep 2018].
44 Önder Z. *The economics of tobacco in turkey: new evidence and demand estimates, economics of tobacco series paper; No.2.World bank NHP discussion paper*, 2002: 7–72.
45 Chaloupka FJ, Straif K, Leon ME. Effectiveness of Tax and price policies in tobacco control. *Tob Control* 2011;20:235–8.
46 White JS, Li J, Hu T-wei, *et al*. The effect of cigarette prices on brand-switching in China: a longitudinal analysis of data from the ITC China survey. *Tob Control* 2014;23:i54–60.
47 Ross H, Blecher E, Yan L, *et al*. Do cigarette prices motivate smokers to quit? new evidence from the ITC survey. *Addiction* 2011;106:609–19.