Price and Income Elasticity of Demand for Alcohol Products in Montenegro

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1 INTRODUCTION

The consumption of alcohol is linked to numerous negative health consequences and societal issues. In order to mitigate issues related to alcohol, governments around the world have implemented extensive measures. These efforts encompass health promotion programs, counter-marketing initiatives, regulating physical availability, overseeing product labels, imposing restrictions on advertising, and raising alcohol taxes (Tian & Liu, 2011).

Raising alcohol taxes is recognized by the United Nations as the most impactful alcohol-pricing strategy for diminishing alcohol consumption and alleviating its detrimental social and economic consequences (Chaloupka et al., 2019). Also, the World Health Organization (WHO) states in its Global Strategy to Reduce the Harmful Use of Alcohol that the success of pricing policies in curbing harmful alcohol use depends on the presence of a strong and efficient taxation system, complemented by sufficient tax collection and enforcement mechanisms.(WHO, 2010)

In Montenegro, situated among low- and middle-income countries (LMICs), the consumption of alcohol is traditionally prevalent and socially accepted. According to WHO data on alcohol consumption in litres of pure alcohol, Montenegro registered a notably high average alcohol intake of 10.34 liters in 2019. (WHO, 2019)

The latest official data on the prevalence of alcohol for the whole Montenegrin population dates from 2017, when the Institute for Public Health conducted a national study "Study of quality of life, life styles and health risks of Montenegrin residents" (Institute for Public Health, 2017). The prevalence rate of alcohol consumption is greater than 40.4 percent for all three periods measured (lifetime, 12 months, 30 days). What is also concerning is that the highest prevalence is in the age group of young adults (15 to 34 years). The 2017 national study also analyzes the preferences for alcoholic beverage types. The most preferred drink is beer (39 percent of all adults, 48.5 percent of young adults, 53.3 percent of young people), followed by wine, then spirits.

Among the youth population, the latest official data related to alcohol prevalence are from 2019, published by the European School Survey on the Use of Alcohol and Other Drugs among Young People (ESPAD). In the previous 12 months (this time frame is considered as the most realistic indicator of alcohol consumption) alcohol prevalence was 68 percent for boys and 57 percent for girls. Compared to previous surveys, prevalence increased in general (ESPAD, 2019).

In order to reduce the prevalence and consumption of alcohol, the government of Montenegro has often worked on changes to the law on excise taxes and has tried to implement an adequate excise taxation policy. This is particularly important because Montenegro is exempt from customs tariffs on the import of alcoholic beverages (Official Gazzete of Montenegro, 2018) as a participant of the European Free Trade Association (EFTA), the Central European Free Trade Agreement (CEFTA), and a member of the World Trade Organization (WTO) (Official Gazette of Montenegro, 2018). These accessions led to a surge in imports and increased promotion of branded alcoholic beverages. The significance of implementing an effective excise-taxation policy is crucial not only for maintaining public-finance sustainability, but also for safeguarding public health. Compared to the countries of the European Union, Montenegro has lower excise tax rates on beer, wine, and spirits (European Commissions, n.d.).

Using the Deaton model, this paper examines the price elasticity of the demanded quantity of alcoholic beverages (beer and spirits) leveraging variations in both time and spatial prices. The analysis is conducted based on available Household Budget Survey data for the period of 2006–2015, 2017, and 2021.

Examining alcohol consumption among residents of LMICs holds particular significance. The lower levels of income in such countries may render the average consumers more responsive to fluctuations in prices and taxes compared to consumers in economies with higher income and education levels. Our study makes a significant contribution by providing estimated results that can serve as a foundation for policy planning and national studies. Additionally, the estimation of elasticity can be utilized to model and predict the impacts of excise tax increases on the sustainability of public finances.

1.1 Literature review

There are a wide range of studies related to own-price elasticities for alcoholic beverages in different countries. In this research, we point out own-price elasticities in HICs and LMICs for each type of alcoholic beverage (beer, wine, and spirits).

There are variations in the elasticity of different beverage types to changes in their own prices. Previous research from HICs indicates that the demand for beer tends to be less responsive to price changes compared to wine and spirits. The own-price elasticity for beer ranges from -0.17 to -0.98, while for wine it ranges from -0.30 to -1.85, and for spirits from -0.01 to -4.65 (please see Table 1.1). Ramful and Zhao (2008a) reveal distinct associations between the three alcohol products and diverse demographic segments in Australia. It seems that males exhibit a higher likelihood of consuming beer, while they demonstrate a lower likelihood of consuming wine and spirits compared to females. Additionally, their findings indicate a concerning trend, with a notable proportion of young females engaging in the consumption of spirits.

In LMICs, men consume more alcohol than women (Leung et al., 2019). However, increasing wealth and progress in gender equality in societies may contribute to a potential increase in the future prevalence of hazardous alcohol consumption among women. Generally, research findings indicate that—in contrast to HICs—spirits tend to exhibit lower responsiveness to price changes compared to beer and wine in LMICs. As presented in Table 1.1, the own-price elasticity for spirits ranges from -0.33 to -1, while for beer it ranges from -0.36 to -1.48, and for wine from -0.585 to -1.85. It is important to note that these elasticity values are not directly comparable, as they are derived from distinct methodologies.

Guindon et al. (2022) conducted a comprehensive survey of alcohol-related studies, including 30 reviews, which encompassed HICs as well as LMICs. Their findings revealed significant variations in estimated elasticities for beer, wine, and spirits, both across different periods and in diverse geographical locations, data sets, and estimation approaches. In nearly all instances, the own-price elasticities were consistently negative. The reviews indicate that the short- and long-run total own-price elasticity in HICs for alcohol is approximately -0.5 and -0.8, respectively. Additionally, the own-price elasticities are approximately -0.3 for beer, -0.6 for wine, and ranging from -0.5 to -0.8 for spirits. Ramful & Zhao (2008) estimated own-price elasticities in Australia (HIC). For wine, it is -1.85, for beer -0.95, and spirits -0.73. These findings suggests that participation in wine consumption is highly responsive to changes in its own price. In the Philippines, in the case of beer, the coefficient is -1.48, signifying that a one-percent increase in the price of beer would result in a 1.48-percent decrease in consumption (Rutcher M., 2022). Moreover, the findings suggest that the price elasticity of demand for distilled spirits conducted in this LMIC appears to be unitary elastic, suggests that a one-percent increase in price corresponds to a proportional one-percent decrease in consumption.

Regarding the methods used for estimation, price and income elasticities are typically derived from demand models that are estimated through ordinary least squares (OLS). Less-utilized estimation techniques include generalized least squares (GLS), single equation maximum likelihood (MLE), full information maximum likelihood (FIML), generalized method of moments (GMM), and Deaton’s methodology (AIDS).

Table 1.1. Overview of evidence on alcohol own-price elasticities for HICs and LMICs

By beverage type				
	Author	**Methodology**	**Results (own-price elasticity)**	**LMICs/ HICs**
Beer	Wagenaar et al., 2009	meta analysis	-0.17	not defined
	Elder et al., 2010	systematic review	-0.5	HIC
	Gallet, 2007	meta analysis	-0.36	not defined
	Ramful & Zhao, 2008	multivariate probit (MVP) and univariate probit (UVP) models	-0.95	HICs
	Meng et al., 2014	pseudo panel	-0.98	HICs

	Guindon et al., 2022	systematic review	-0.3	HICs
	Sornpaisarn et al., 2013	meta analysis	-0.5	LMICs
	Villa, 1999	Deaton model	-1.069	LMICs
	Urzúa, 2013	Deaton model	-1.082	LMICs
	Leifman & Trolldal, 2020	ARIMA log log model	-1.05	LMICs
	Rutcher, 2022	ADF model	-1.48	LMICs
	Agwaya & Ochieng, 2021	Deaton model	-0.366	LMICs
Wine	Wagenaar et al., 2009	meta analysis	-0.3	not defined
	Fogarty, 2010	meta analysis	from -0.05 to -3	HICs (17 countries)
	Gallet, 2007	meta analysis	-0.7	not defined
	Ramful & Zhao, 2008	multivariate probit (MVP) and univariate probit (UVP) models	-1.85	HICs
	Guindon et al., 2022	systematic review	-0.6	HICs
	Villa, 1999	Deaton model	-0.585	LMICs
Spirits	Wagenaar et al., 2009	meta analysis	-0.29	not defined
	Gallet, 2007	meta analysis	-0.68	not defined
	Ramful & Zhao, 2008	multivariate probit (MVP) and univariate probit (UVP) models	-0.73	HIC
	Meng et al., 2014	pseudo panel	-0.08	HICs
	Guindon et al., 2022	systematic review	-0.65	HICs
	Villa, 1999	Deaton model	-0.777	LMICs

	Rutcher M., 2022	ADF model	-1	LMICs

Any price increase of a particular alcoholic beverage, like beer, can result in shifts in the demand for other alcoholic beverages, such as wine or spirits, and/or alterations in the demand for non-alcoholic beverages. These impacts are assessed through cross-price elasticities. In specific instances, uniform changes in taxes across different categories of alcoholic beverages may lead to minimal or no adjustments in relative prices. The cross-price elasticities between alcoholic beverages are very small in HICs, varying from 0.0527 (measured between different beer brands) (Rojas & Peterson, 2008) to 0.6 (measured between beer and spirits) (Ramful & Zhao, 2008).

Table 1.2. Overview of evidence on alcohol cross-price elasticities

Author	Methodology	Results	LMICs/ HICs
Ramful & Zhao, 2008	multivariate probit (MVP) and univariate probit (UVP) models	Cross-price elasticity between beer and spirits is 0.6, while between wine and beer it is about 0.4.	HICs
Rojas & Peterson, 2008	DM method	All cross-price elasticities between beer brands are positive and have a median value of 0.0527.	HICs
Gruenewald et al., 2006	SURE model	Cross-price elasticities related to higher-quality beverages suggest that greater prices among higher-quality beverages led to increases in sales of lower-quality beverages within each beverage type (spirits: 0.255l;	HICs

		wine: 0.339; beer: 0.720).	
Meng et al., 2014	pseudo panel	Cross-price elasticities for 10 types of alcoholic beverages are smaller in magnitude with a mix of positive and negative signs.	HICs
Ornstein, 1980	review study	Inconsistent findings were observed in relation to cross-price elasticities (beer, wine, and spirits).	HICs

1.2 Deaton method

This study uses Deaton and Muellbauer's (1980) almost ideal demand system (AIDS) (Deaton, 1988; Deaton & Muellbauer, 1980) to estimate own-price and cross-price elasticities for spirits in Montenegro. The model enables the estimation of demand systems based on consumer behavior. The decision-making process of households is influenced by factors such as quality, product price, and quantity within specific clusters. The analysis places significant importance on clusters, operating under the assumption that households within the same cluster pay identical prices for commodities, while variations in prices exist across different clusters. In this context, clusters are defined as small territories or units, specifically municipalities, where households reside. Surveys are conducted on households within the same cluster over the same time period. The fundamental premise of the model is to compare living standards over time and across different geographical areas.

The data source for the empirical approach is the Household Budget Survey (HBS), conducted by the Statistical Office of Montenegro (MONSTAT). Respondents provide information on the overall expenditure associated with various goods and services (total amount paid) and quantity of products consumed. Direct price information in HBS is not available, which is not an obstacle to research when using this model. On the contrary, the Deaton model is most often used in these circumstances.

Deaton's approach involves several sequential steps. Initially, unit values, (proxy for price) need to be calculated from the household-level survey data. This involves dividing the overall expenditure on alcohol by the quantity of alcohol demanded, as follows:

$$Uv_{jc}=\frac{alkjc}{qjc} \quad (1),$$

where Uv_{jc} is unit value, alk_{jc} and qjc are, respectively, the expenditure and quantity of alcohol in household j located in cluster c. Deaton opts for unit values instead of actual prices because of the limited availability of individual household price information in household consumption surveys.

In the next step of Deaton's method, the researcher verifies whether the central identifying assumption is valid—namely, the spatial variation of prices (unit values). This involves assessing whether the unit values obtained in the previous step exhibit spatial variability. Then Deaton's model, or demand system, is characterized by two equations:

$$w_{jc}=\alpha+ \beta ln x_{jc}+\gamma z_{jc}+\theta ln \pi_c+(FE_c + u_{jc}) \quad (2)$$

$$ln v_{jc}=\lambda+\mu ln x_{jc}+\Omega z_{jc}+\psi ln \pi_c+e_{jc} \quad (3),$$

where dependent variables are:

w_{jc}- the share of alcohol expenditure in total household expenditure for household j in cluster c and

$ln v_{jc}$- unit value for household j in cluster c;

while independent variables are:

$ln x_{jc}$- expenditure,

$ln\pi_c$- price, and

z_{jc}- sociodemographic characteristics.

The next step of Deaton's method involves removing the influences of household expenditure and household characteristics from both household-level demand and unit values. Subsequently, the data are aggregated across clusters. This step is executed using the following equations:

$$\widehat{y_c^1} = \frac{1}{nc}\sum_{j=1}^{nc}(\mathrm{wjc} - \hat{\beta}^1 lnxjc - \hat{Y}zjc) \tag{4}$$

$$\widehat{y_c^2} = \frac{1}{nc}\sum_{j=1}^{nc}(\mathrm{lnvjc} - \hat{\mu}^1 lnxjc - \hat{\Omega}zjc) \tag{5}$$

where:

n_c- number of households in cluster c,

$\widehat{y_c^1}$- estimates of cluster average unit value, and

$\widehat{y_c^2}$- estimates of cluster average demand after removing the effects of household expenditure and household characteristics.

Following the identifying assumption, price elasticities of demand are derived by observing how cluster-level demand responds to changes in cluster-level prices. The fifth step entails conducting a regression, wherein cluster-level demand ($\widehat{y_c^2}$) is regressed on cluster-level unit values ($\widehat{y_c^1}$):

$$\varphi^{\wedge} = \frac{\boldsymbol{COV}\left(\widehat{y_c^2}, \widehat{y_c^1}\right) - \frac{\widehat{\sigma^{12}}}{nc}}{\boldsymbol{VAR}\left(\widehat{y_c^1}\right) - \frac{\widehat{\sigma^{11}}}{n_c^+}} \tag{6}$$

where:

n_c^+ - number of households in a village reporting positive expenditures on alcohol;

n_c - number of households in a village;

$\widehat{\sigma^{12}}$ - estimate of the covariance of the errors in equations (2) and (3); and

$\widehat{\sigma^{11}}$ - variance of the errors in equation (3).

The final step in Deaton's method involves applying quality correction formulas to obtain the estimate of the price elasticity of demand:

$$\overline{\mathcal{E}p} = \left(\frac{\hat{\theta}}{\bar{w}}\right) - \widehat{\Psi} \quad (7)$$

where:

$\bar{w}$- is the average share of total household expenditure dedicated to alcohol in the sample, and

$\widehat{\Psi}$ and $\bar{\theta}$ are the estimates of the coefficients on the unobserved price terms in equations (2) and (3).

In Montenegro, HBS was carried out annually for the period from 2006 to 2021 (excluding 2016, 2018, 2019, and 2020 when the survey was not conducted) in every municipality, across three regions: Central, North, and South (*Statistical Office of Montenegro - MONSTAT*, n.d.-a). The North region, characterized as the least developed, consists of 11 municipalities. The Central region includes the four largest municipalities, including the capital city. The South region comprises six coastal municipalities that generate the highest income from tourism.

1.3 Data and descriptive statistics

To estimate the elasticity of alcohol consumption (separately for spirits, wine, and beer) in terms of price, we employ data extracted from the Household Budget Survey (HBS) covering the years 2005 to 2021 (Statistical Office of Montenegro – Monstat). The HBS, an annual national survey, specifically delves into the spending patterns and consumption behaviors of households concerning goods and services. The survey data are categorized based on various household characteristics such as income, socioeconomic factors, size, composition, and municipality.

As previously discussed in the methodology section, unit values are derived by dividing the monthly household spending on different types of alcohol by the quantity purchased within that month. Each household undergoes a single survey session annually, taking place over one month. The unit values are denominated in euros per liter. The budget share is calculated as the ratio of monthly household alcohol expenditure to the total monthly household expenditure. Expenditure on alcohol and total expenditure variables are adjusted to real values using the Consumer Price Index.

The data include a total of 254 clusters in the sample (the total sample consisted of 16,323 households). Socio-demographic variables used in the analysis were ln of household size (number of members in household), male ratio (percentage of males in household) and adult ratio (percentage of adults older than age 15 in household), maximum education (maximum years of education of a member in the household), average age of household members, age and gender of household head, and the household's activity classified as 1) unemployed, 2) pensioners, or 3) employed.[1] Descriptive statistics for all socio-demographic variables used in the first-stage regressions, along with the unit value, budget share, and total expenditure (ln), are outlined in Table 1.3.

Table 1.3. Descriptive statistics

	Observations	Mean	Std. Dev.	Min	Max
Unit value beer	6,375	0.87	0.20	0.42	1.76
Unit value wine	3,516	2.41	0.91	1.04	6.57
Unit value spirits	4,567	7.99	2.85	2.29	22.25
Budget share beer	6,375	0.01	0.01	0.00	0.05
Budget share wine	3,516	0.01	0.01	0.00	0.04
Budget share spirits	4,567	0.02	0.02	0.00	0.13

[1] 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).

Total expenditure	16,323	1,123	815	120	5,400
Household size	16,323	3.13	1.66	1.00	8.00
Male ratio	16,323	0.47	0.27	0.00	1.00
Adult ratio (15+)	16,323	0.90	0.18	0.38	1.00
Maximum education	16,323	5.56	2.14	1.00	9.00
HH members - average age	16,323	46.63	17.68	16.00	85.00
HH head - males	16,323	0.74	0.44	0.00	1.00
HH head - age	16,323	58.56	13.41	28.00	87.00
Household type -					
Unemployed	16,323	0.09	0.28	0.00	1.00
Pensioners	16,323	0.33	0.47	0.00	1.00
Employed	16,323	0.58	0.49	0.00	1.00

Source: Author's calculation based on HBS data (2005-2015, 2017, and 2021)

According to the data, a significant portion of respondents, accounting for 39 percent, prefer beer, followed by 28 percent who opt for spirits and 22 percent who opt for wine (sparkling wine was excluded from the analysis, as it represents only 0.4 percent of the sample). This consumption pattern can be attributed to the average prices of these beverages, where beer stands out as the least expensive with an average price of 90 cents per liter, while spirits are the priciest, averaging eight euros per liter. Due to that fact, the highest budget share (two percent) is spent on spirits, while on average one percent of household budget are spent on beer and wine (see more details in Table A1 in the Appendix). Overall, the prevalence of total alcohol use (at least one alcoholic beverage consumed) is high and amounts to 55 percent on average.

The majority of household members (90 percent) are adults aged 15 and older, with an average age of 47 years, and roughly half of them are males. Furthermore, approximately nine percent of households are labeled as "unemployed" and 33 percent as "pensioners," while the majority, comprising 58 percent, are categorized as "employed." On average, households consist of three members. Data on education indicate that, on average, the maximum education of adult household members is at the tertiary level.

1.4 Results

The outcomes outlined in the Appendix (Table A.3) are derived from a regression analysis examining changes over time and across regions in the real unit values and budget shares of alcoholic beverages. The results underscore substantial regional disparities in both the unit values and budget shares across all alcoholic beverages. Specifically, there are significant fluctuations over time in the unit values of spirits, with notable variations observed in budget shares, particularly in the last five years. Similar patterns are observed for wine, with noteworthy changes in both unit values and budget shares. In the case of beer, the results reveal significant variations in unit values, but not in budget shares. The main assumption of Deaton's model is satisfied, due to proof of the significant cluster and spatial variation.

The results from the unit value regression indicate that the prices of all three types of beverages are higher in the South and lower in the North, compared to the Central region. Households in the North region spend more on alcohol compared to the Central Region.

1.4.1 First stage – household-level regression

Table 1.4 shows the results of the first stage regression. The quality elasticity of expenditure is significant in the case of each alcohol type, equaling 0.039, 0.064 and 0.013 for spirits, wine, and beer, respectively. These data reflect the possibility to spend more on more expensive beverages. For instance, households with 10-percent higher expenditure would buy spirits that are about 0.4 percent more expensive. Therefore, Deaton's model represents the optimal methodology, due to the proven existence of quality shading.

As expected, households with more members tend to buy cheaper alcohol (spirits, wine, and beer), along with "unemployed" households which spend less money on spirits compared to "employed" households. Having more males in a household is associated with consumption of less-expensive beer (not significant for spirits and wine). Higher average age of household members leads to the consumption of less-expensive spirits. Other variables from the regression had no effect on the unit value (coefficients not statistically significant).

Table 1.4. First-stage regression results

VARIABLES	uvspirits	se	bsspirits	se	uvwine	se	bswine	se	uvbeer	se	bsbeer	se
Total expenditure (ln)	0.039***	(0.008)	- 0.003***	(0.000)	0.064***	(0.011)	- 0.000***	(0.000)	0.013**	(0.005)	- 0.001***	(0.000)
Household size (ln)	- 0.052***	(0.012)	0.001***	(0.000)	- 0.060***	(0.018)	0.000*	(0.000)	-0.020**	(0.008)	0.000*	(0.000)
Male ratio	0.001	(0.019)	0.004***	(0.000)	-0.013	(0.026)	0.000***	(0.000)	-0.030**	(0.013)	0.002***	(0.000)
Adult ratio	0.035	(0.028)	0.001**	(0.001)	-0.040	(0.038)	0.000	(0.000)	-0.022	(0.019)	0.001***	(0.000)
Maximum education	0.007***	(0.002)	- 0.000***	(0.000)	0.008**	(0.003)	0.000***	(0.000)	0.003	(0.002)	-0.000	(0.000)
Household type – employed												
Unemployed	-0.033**	(0.016)	0.000	(0.000)	0.019	(0.028)	-0.000	(0.000)	-0.019	(0.012)	0.000	(0.000)
Pensioners	-0.012	(0.012)	0.000	(0.000)	0.011	(0.017)	-0.000	(0.000)	-0.001	(0.009)	-0.000	(0.000)
HH members – average age	-0.001**	(0.001)	0.000***	(0.000)	-0.000	(0.001)	0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)
HH head – males	0.008	(0.013)	0.001***	(0.000)	0.004	(0.018)	0.000***	(0.000)	0.006	(0.009)	0.001***	(0.000)
HH head – age	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.001)	-0.000	(0.000)	0.000	(0.000)	0.000	(0.000)

Constant	1.814***	(0.054)	0.018***	(0.001)	0.457***	(0.076)	0.002***	(0.000)	- 0.226***	(0.037)	0.006***	(0.001)
R-squared	0.503		0.182		0.268		0.075		0.245		0.122	
F	11.53		77.27		6.591		11.66		2.749		59.17	
r2_a	0.474		0.169		0.217		0.0599		0.214		0.108	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations based on HBS data

When it comes to the estimated coefficients from the budget share equation, the result are significant, but with very low magnitude. In the case of an increase in expenditure, households tend to spend less of their budget on alcohol. Larger households with more males and adults spend larger shares of their budgets on all three types of beverages.

1.4.2 Second stage – elasticity estimate

The results show (Table 1.5) that total own-price elasticity estimate is only significant in the case of spirits, amounting to -0.884 (estimated using whole households in sample).[2] This means that an increase in the price of spirits by 10 percent would lead to a reduction of demand for this type of beverage by 8.84 percent. We used the bootstrap procedure (with 1,000 replications) to estimate the standard error of the elasticity.

Table 1.5. Unconditional total own-price and income elasticity

	Spirits		Wine		Beer	
	Coef	Se	Coef	Se	Coef	Se
Price	-0.884**	(0.389)	-0.386	(0.618)	-1.007	(0.747)
Income	0.389***	(0.041)	0.663***	(0.046)	0.605***	(0.035)

In contrast, income elasticity is positive and significant in the cases of all types of beverages, being higher for wine and beer. For instance, if income increases by 10 percent, demand for spirits will increase by 3.89 percent. Therefore, an increase in the standard of living could potentially neutralize the effects of alcohol excise tax increases.

It is important to analyze and understand the economic relation between products, or different alcohol types, which is done through estimation of cross-price elasticities. The cross-price elasticity shows the effect of a change in the price of

[2] In case the estimation is done on the sample of households with positive consumption, the conditional own-price elasticity for spirits is also significant and equals -0.571 (SE=0.093). The conditional own-price elasticity for wine and spirits is not statistically significant.

one on the consumption of another beverage type. In Montenegro, all cross-price elasticities between all three types of beverages are insignificant (Table A.2 in the Appendix). Similarly, as in the existing empirical research, the magnitudes of cross-price elasticities are significantly small (Guindon et al., 2022; Edwards, 1997). A recent comprehensive analysis determined that there is no evidence of significant substitution across different beverage categories in HICs (for example, from beer to wine or spirits) (Chaloupka et al., 2019).

1.4.3 Simulation

In this study, we aim to illustrate the favorable outcomes resulting from alterations in excise taxes. Specifically, our research involves simulating the impact of these tax adjustments on the consumption of alcohol (spirits) and fiscal revenues. The fundamental premise of our simulation model is based on the perfect elasticity of the supply function, implying that the entire tax burden falls on consumers. The calculation for the change in consumption due to price and income increases is formulated as follows:

$$C_{t+1} = C_t\left(1 + e_p \times \Delta p_c + e_i \times i_g\right) \tag{8}$$

where C_{t+1} is the new demand, C_t is the demand in year t, e_p and e_i are price and income elasticities, while Δp is the percentage change of retail prices increase, and i_g is the GDP growth rate.

Assumptions of the simulation are as follows:

- spirits consumption: 724,050 liters,
- retail price: EUR 20 per 1 liter on average,
- specific excise: EUR 12.5 per 1 liter (Law on Excise Tax, 2023)
- spirits' price elasticity -0.884, income elasticity 0.389, and
- real GDP growth 3.1 percent.(*Statistical Office of Montenegro - MONSTAT*, n.d.-b)

Table 1.6. Baseline scenario

Alcohol category	Consumption	Retail (EUR)	Tax per unit (EUR)		Net of tax price	Revenue collection (EUR, millions)		
	Quantity (liters)	Price	Excise	VAT		Total	VAT	Total tax
Spirits	724,000	20	12.50	3.47	10.66	4.254	2.512	6.766

An assumed increase in the specific spirits excise tax, from EUR 12.5 to 15 per liter in accordance with the excise calendar, Decision, No. 00-72/17-35/3 (2017) would lead to a seven-percent increase in price. This change is anticipated to result in a 5.08-percent decline in total consumption, while fiscal revenues are expected to see an increase of 9.36 percent (Table 1.7).

Table 1.7. Increase price via tax – effects on revenue and consumption

Alcohol category	Elasticities		Revenue collection (EUR)			
	Price	Income	Consumption (new)	Total excise	VAT	Total tax
Spirits	-0.884	0.389	687,284	4,845,352.2	2,554,399.3	7,399,751.5

2 Discussion and Conclusion

To estimate the impact of excise tax increases on alcohol beverage consumption, we have applied Deaton's methodology and included in the sample all three types of drinks – spirits, wine, and beer. The only significant elasticity estimate was obtained in the case of spirits, which is in line with the previously conducted empirical research. Our results indicate that the increase of price by 10 percent would reduce spirits consumption by 8.84 percent. However, policy makers should take into account changes in the standard of living, as an increase of income by 10 percent could potentially increase demand for spirits by 3.9 percent. These estimates suggest that changes in income could neutralize the alcohol excise tax increases. The results of cross-price elasticities between the three types of alcoholic beverages were not significant.

The aim of the research was also to show that, besides the positive effect of tax increases on alcohol use reduction, policy makers should consider the impact on public revenues. For this purpose, the study includes simulations of spirits price and excise tax changes on government revenues. Currently the uniform excise tax (alcohol-content-based) amounts to 12.5 euros per liter of pure alcohol. Assuming that the specific spirits excise tax increases from 12.5 to 15 euros per liter (according to the excise calendar), Decision, No. 00-72/17-35/3 (2017) the price would increase by seven percent, total consumption would decrease by 5.08 percent, and fiscal revenues would increase by 9.36 percent. Hence, the projected elasticities indicate that raising excise taxes could serve as a highly effective strategy in reducing the adverse impact of spirits on the productivity, health, and financial well-being of household members. Consequently, this approach could yield positive outcomes for national income and contribute to the sustainable development progress of the country (SDGs 1, 3, 8, 10).

Income generated from taxes serves as a crucial funding stream for diverse government initiatives, particularly those focused on health and youth. The escalating prevalence of alcohol and cigarette consumption should serve as a prompt for immediate and comprehensive reforms, with a need for improved prevention and treatment programs for alcohol use.

A potential limitation of this study could be found in the fact that HBS does not contain data on retail prices. Additionally, the database lacks information on homemade spirits production which is consumed in households. Similarly, considering the data are aggregated, it is not possible to obtain a precise overview of the alcohol market due to the lack of information specifically considering production of small producers.

References

Agwaya, R., & Ochieng, J. (2021). Demand Elasticities of Excisable Goods in Kenya: Estimation Using Almost Ideal Demand System. *Financing for Development*, *1*(3), Article 3.

Chaloupka, F. J., Powell, L. M., & Warner, K. E. (2019). The Use of Excise Taxes to Reduce Tobacco, Alcohol, and Sugary Beverage Consumption. *Annual Review of Public Health*, *40*(1), 187–201. https://doi.org/10.1146/annurev-publhealth-040218-043816

Deaton, A. (1988). Quality, Quantity, and Spatial Variation of Price. *The American Economic Review*, *78*(3), 418–430.

Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. *THE AMERICAN ECONOMIC REVIEW*, *70*(3).

Decision, No. 00-72/17-35/3. (2017). *(Official Gazette of Montenegro. Decision, No. 00-72/17-35/3 'Official Gazette of Montenegro., No. 52/2017' from 08.08.2017*.

Edwards, G. (1997). Alcohol policy and the public good. *Addiction*, *92*(3s1), 73–80. https://doi.org/10.1046/j.1360-0443.92.3s1.16.x

Elder, R. W., Lawrence, B., Ferguson, A., Naimi, T. S., Brewer, R. D., Chattopadhyay, S. K., Toomey, T. L., & Fielding, J. E. (2010). The Effectiveness of Tax Policy Interventions for Reducing Excessive Alcohol Consumption and Related Harms. *American Journal of Preventive Medicine*, *38*(2), 217–229. https://doi.org/10.1016/j.amepre.2009.11.005

ESPAD. (2019). *ESPAD Report 2019 | www.espad.org*. http://www.espad.org/espad-report-2019

European Commissions. (n.d.). *Taxes in Europe Database v3*. Retrieved 7 April 2024, from https://ec.europa.eu/taxation_customs/tedb/taxSearch.html

Fogarty, J. (2010). The Demand for Beer, Wine and Spirits: A Survey of the Literature. *Journal of Economic Surveys*, *24*, 428–478. https://doi.org/10.1111/j.1467-6419.2009.00591.x

Gallet, C. A. (2007). The demand for alcohol: A meta-analysis of elasticities*. *Australian Journal of Agricultural and Resource Economics*, *51*(2), 121–135. https://doi.org/10.1111/j.1467-8489.2007.00365.x

Gruenewald, P. J., Ponicki, W. R., Holder, H. D., & Romelsjö, A. (2006). Alcohol Prices, Beverage Quality, and the Demand for Alcohol: Quality Substitutions and Price Elasticities. *Alcoholism: Clinical and Experimental Research*, *30*(1), 96–105. https://doi.org/10.1111/j.1530-0277.2006.00011.x

Guindon, G. E., Zhao, K., Fatima, T., Garasia, S., Quinn, N., Baskerville, N. B., & Paraje, G. (2022). Prices, taxes and alcohol use: A systematic umbrella review. *Addiction*, *117*(12), 3004–3023. https://doi.org/10.1111/add.15966

Institute for Public Health. (2017). *Izvještaj o kvalitetu života, životnim stilovima i rizicima*. Institut za javno zdravlje Crne Gore. https://www.ijzcg.me/me/izvjestaji/izvjestaj-o-kvalitetu-zivota-zivotnim-stilovima-i-rizicima

Law on Excise Tax. (n.d.). *(Law on Excise Tax, 'Official Gazette of Montenegro', No. 065/01 from 31.12.2001, 012/02 from 15.03.2002, 076/05 from 16.12.2005, 'Official Gazette of Montenegro', No. 076/08 from 12.12.2008, 050/09 from 31.07.2009, 078/10 from 29.12.2010, 040/11 from 08.08.2011, 061/11 from 23.12.2011, 028/12 Od 05.06.2012,* *038/13 from 02.08.2013, 045/14 from 24.10.2014, 008/15 Od 27.02.2015, 001/17 from 09.01.2017, 050/17 from 31.07.2017, 055/18 from 01.08.2018, 076/20 from 28.07.2020, 049/22 from 06.05.2022, 065/22 from 21.06.2022, 152/22 from 30.12.2022, 027/23 from 08.03.2023)*.

Leifman, H., & Trolldal, B. (2020). Price and income elasticities for alcohol in Sri Lanka. *International Journal of Alcohol and Drug Research*, *8*(2), Article 2. https://doi.org/10.7895/ijadr.277

Leung, J., Chiu, V., Connor, J. P., Peacock, A., Kelly, A. B., Hall, W., & Chan, G. C. K. (2019). Alcohol consumption and consequences in adolescents in 68 low and middle-income countries – a multi-country comparison of risks by sex. *Drug and Alcohol Dependence*, *205*, 107520. https://doi.org/10.1016/j.drugalcdep.2019.06.022

Meng, Y., Brennan, A., Purshouse, R., Hill-McManus, D., Angus, C., Holmes, J., & Meier, P. S. (2014). Estimation of own and cross price elasticities of alcohol demand in the UK—A pseudo-panel approach using the Living Costs and Food Survey 2001–2009. *Journal of Health Economics*, *34*, 96–103. https://doi.org/10.1016/j.jhealeco.2013.12.006

Official Gazzete of Montenegro. (2018). *Uredba o uslovima i postupku za ostvarivanje prava na oslobodjenje od placanja carine*. Vlada Crne Gore. https://www.gov.me/dokumenta/aee3594e-5806-4dee-a051-5e6e90031232

Ornstein, S. I. (1980). Control of alcohol consumption through price increase. *Journal of Studies on Alcohol*, *41*(9), 807–818. https://doi.org/10.15288/jsa.1980.41.807

Ramful, P., & Zhao, X. (2008a). Individual Heterogeneity in Alcohol Consumption: The Case of Beer, Wine and Spirits in Australia*. *Economic Record*, *84*(265), 207–222. https://doi.org/10.1111/j.1475-4932.2008.00463.x

Ramful, P., & Zhao, X. (2008b). Individual Heterogeneity in Alcohol Consumption: The Case of Beer, Wine and Spirits in Australia*. *Economic Record*, *84*(265), 207–222. https://doi.org/10.1111/j.1475-4932.2008.00463.x

Rojas, C., & Peterson, E. B. (2008a). Demand for differentiated products: Price and advertising evidence from the U.S. beer market. *International Journal of Industrial Organization*, *26*(1), 288–307. https://doi.org/10.1016/j.ijindorg.2006.12.003

Rojas, C., & Peterson, E. B. (2008b). Demand for differentiated products: Price and advertising evidence from the U.S. beer market. *International Journal of Industrial Organization*, *26*(1), 288–307. https://doi.org/10.1016/j.ijindorg.2006.12.003

Rutcher M., L. (2022). *Estimating the Price Elasticity of Demand for Cigarettes and Alcohol Products in the Philippines*. https://cpbrd.congress.gov.ph/2012-06-30-13-06-51/discussion-papers/1477-dp2022-01-estimating-the-price-elasticity-of-demand-for-cigarettes-and-alcohol-products-in-the-philippines

Sornpaisarn, B., Shield, K., Cohen, J., Schwartz, R., & Rehm, J. (2013). Elasticity of alcohol consumption, alcohol-related harms, and drinking initiation in low- and middle-income countries: A systematic review and meta-analysis. *International Journal of Alcohol and Drug Research*, *2*(1), Article 1. https://doi.org/10.7895/ijadr.v2i1.50

Statistical Office of Montenegro—MONSTAT. (n.d.-a). Retrieved 7 April 2024, from https://www.monstat.org/eng/publikacije.php

Statistical Office of Montenegro—MONSTAT. (n.d.-b). Retrieved 26 January 2024, from https://www.monstat.org/eng/page.php?id=19&pageid=19

Tian, G., & Liu, F. (2011). Is the Demand for Alcoholic Beverages in Developing Countries Sensitive to Price? Evidence from China. *International Journal of Environmental Research and Public Health*, *8*(6), Article 6. https://doi.org/10.3390/ijerph8062124

Urzúa, C. M. (2013). Distributive and Regional Effects of Monopoly Power. *Economía Mexicana. Nueva Época*, *22*(2), 279–295.

Villa, A. (1999). La demanda de bebidas alcohólicas en México y la evaluación social de las tasas impositivas aplicadas a su consumo: Un análisis empírico para el período de 1989 a 1995. *Master Degree Thesis*.

Wagenaar, A. C., Salois, M. J., & Komro, K. A. (2009). Effects of beverage alcohol price and tax levels on drinking: A meta-analysis of 1003 estimates from 112 studies. *Addiction (Abingdon, England)*, *104*(2), 179–190. https://doi.org/10.1111/j.1360-0443.2008.02438.x

WHO. (2010). *Global strategy to reduce the harmful use of alcohol*. https://www.who.int/publications-detail-redirect/9789241599931

WHO. (2019). *Alcohol, total per capita (15+) consumption (in litres of pure alcohol) (SDG Indicator 3.5.2)*. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/total-(recorded-unrecorded)-alcohol-per-capita-(15-)-consumption

Appendix

Table A.1. Unit values and budget shares of different alcoholic beverage types

Year	UV spirits	BS spirits	UV beer	BS beer	UV wine	BS wine	Total expenditure
2005	7.535	0.016	0.868	0.006	2.672	0.007	1092
2006	7.498	0.015	0.785	0.006	2.650	0.007	1036
2007	7.952	0.020	0.825	0.006	2.563	0.006	1053
2008	8.261	0.018	0.772	0.006	2.611	0.005	1190
2009	8.215	0.018	0.780	0.006	2.454	0.006	1129
2010	8.638	0.020	0.802	0.006	2.350	0.006	1135
2011	8.693	0.020	0.862	0.006	2.392	0.005	1116
2012	8.012	0.017	0.889	0.006	2.274	0.006	1063
2013	7.662	0.015	0.886	0.006	2.250	0.004	1051
2014	7.462	0.013	0.902	0.005	2.242	0.004	1133
2015	7.818	0.016	0.894	0.006	2.270	0.005	1123
2017	7.935	0.012	0.955	0.005	2.143	0.004	1260
2021	8.315	0.014	1.013	0.005	2.536	0.004	1214

Note: HH with sample of positive consumption

Table A.2. Cross-price elasticities between different alcoholic beverage types

	Spirits		Wine		Beer	
	Coef	Se	Coef	Se	Coef	Se
Spirits	-0.884**	(0.389)	-0.198	(0.215)	0.117	(0.386)
Wine	1.250	(0.896)	-0.386	(0.618)	1.141	(0.799)
Beer	0.447	(0.741)	-0.214	(0.366)	-1.007	(0.747)

Table A.3. Regional and time variation of alcoholic beverage types, unit values, and budget shares

	Spirits				Wine				Beer			
Variables	Unit value	se	Budget share	se	Unit value	se	Budget share	se	Unit value	se	Budget share	se
Region Center	omitted		omitted		omitted		omitted		omitted		omitted	
North	-0.391***	(0.009)	0.002***	(0.001)	-0.044**	(0.017)	-0.000	(0.000)	-0.021***	(0.007)	0.001***	(0.000)
South	0.047***	(0.013)	-0.005***	(0.001)	0.088***	(0.013)	-0.001***	(0.000)	0.038***	(0.007)	-0.002***	(0.000)
Year 2006	-0.002	(0.018)	-0.000	(0.001)	0.010	(0.026)	-0.000	(0.000)	-0.086***	(0.012)	0.000	(0.000)
2007	0.036*	(0.019)	0.005***	(0.001)	-0.086***	(0.028)	-0.001**	(0.000)	-0.050***	(0.013)	0.000	(0.000)
2008	0.064***	(0.019)	0.003**	(0.001)	-0.047*	(0.028)	-0.001***	(0.000)	-0.115***	(0.013)	-0.000	(0.000)
2009	0.056***	(0.020)	0.003***	(0.001)	-0.085***	(0.028)	-0.001**	(0.000)	-0.112***	(0.013)	-0.000	(0.000)
2010	0.094***	(0.019)	0.005***	(0.001)	-0.136***	(0.028)	-0.001	(0.000)	-0.087***	(0.013)	-0.001	(0.000)
2011	0.076***	(0.020)	0.005***	(0.001)	-0.101***	(0.028)	-0.002***	(0.000)	0.005	(0.013)	0.001	(0.000)
2012	0.058***	(0.020)	0.002	(0.001)	-0.165***	(0.028)	-0.001	(0.000)	0.028**	(0.013)	-0.000	(0.000)
2013	-0.053**	(0.021)	0.001	(0.001)	-0.192***	(0.029)	-0.003***	(0.000)	0.024*	(0.014)	-0.000	(0.000)
2014	0.014	(0.021)	-0.002	(0.001)	-0.211***	(0.027)	-0.003***	(0.000)	0.062***	(0.013)	-0.001**	(0.000)

2015	-0.015	(0.020)	0.001	(0.001)	-0.172***	(0.026)	-0.002***	(0.000)	0.021	(0.013)	-0.000	(0.000)
2017	0.023	(0.019)	-0.003***	(0.001)	-0.199***	(0.025)	-0.002***	(0.000)	0.117***	(0.012)	-0.001***	(0.000)
2021	0.089***	(0.022)	-0.002	(0.001)	-0.093***	(0.027)	-0.003***	(0.000)	0.155***	(0.012)	-0.001**	(0.000)
Constant	2.126***	(0.014)	0.016***	(0.001)	0.917***	(0.019)	0.007***	(0.000)	-0.176***	(0.009)	0.007***	(0.000)
Observations	4,567		4,567		3,516		3,516		6,375		6,375	
R-squared	0.345		0.039		0.065		0.043		0.149		0.035	
F	170.9		13.25		17.26		11.27		79.56		16.67	
r2_a	0.343		0.0362		0.0608		0.0393		0.147		0.0333	

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations based on HBS data

Note: To check the validity of this assumption (variations of unit values between clusters), we used Analysis of Variance (ANOVA) to split total unit values variation in two parts: within and between-cluster variation. Test results for all three types of beverages showed significant F-statistic values (spirits F=17.22, prob>F=0.000; wine F=5.17, prob>F=0.000; beer F=8.09, prob>F=0.000). The results indicate that unit values can be seen as informative of prices. The main assumption of the Deaton model is satisfied.