Affordability of Cigarettes in Southeastern European Countries

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Abstract

Background

The World Health Organization (WHO) and the World Bank advocate for periodic re-evaluation of tobacco tax levels taking into account both price and income elasticity of demand for tobacco products. Excise increases should exceed or at least keep pace with real income growth (GDP per capita used as a proxy), ensuring that tobacco products are becoming less affordable over time. In the Southeastern European (SEE) region, there is no regional analysis of the affordability trends including estimation of the impact that affordability has on consumption of cigarettes.

Methodology

We employed two approaches to analyze affordability trends in ten SEE countries over the period 2009–2019 (Model 1) and 2008-2018 (Model 2). First, to analyze affordability trends in the observed period, we used two affordability measures: the tobacco affordability index (TAI), calculated using data on gross domestic product (GDP) growth and overall/tobacco consumer price indices, and the relative income price (RIP) measure retrieved from the Global Health Observatory (GHO) database of the WHO. Using the two affordability measures as explanatory variables, we specified two econometric models assessing the impact of affordability on consumption of cigarettes.

Results

The affordability of cigarettes in the selected SEE countries decreased on average but showed different patterns over the observed period. The decrease in affordability using the RIP approach ranges from around 247 percent in Montenegro to 15 percent in Bulgaria. Both applied models confirm affordability as the main determinant of tobacco consumption. Model 1 shows that a decrease in affordability (measured by TAI) by one percentage point results in a 1.2 percentage point decrease in the annual consumption. In Model 2 we estimated affordability elasticity (-1.1), showing that a decrease of affordability by 1 percent results in a decrease of consumption by 1.1 percent.

Conclusions

During 2008-2018, the decrease in affordability of cigarettes was a crucial determinant in reducing consumption of cigarettes in the SEE region. However, affordability is still not considered when designing national tobacco taxation policies. For example, in the period of economic growth (2017–2018) affordability in most of the observed countries increased slightly. Therefore, policy makers should be aware of the risk that future increases in cigarette prices could lag behind real income growth, making tax policy less effective at reducing consumption.

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Introduction

Research background

Demand for cigarettes is sensitive to price changes, similar to that of other consumable goods. Taxation, due to its impact on price, is therefore considered an effective tool for reducing demand for cigarettes (Chaloupka et al., 2012; Savedoff & Alwang, 2015; Ho et al., 2018). However, the effects of taxation largely depend on changes in income, as increasing incomes can easily offset the price effects (Husain et al., 2017).

The relationship between the price of a product and income is often explained through the concept of affordability, which is defined as the ratio of price to income. Affordability changes are particularly relevant for low- and middle-income countries striving to compete with higher-income countries by achieving relatively higher growth rates. In cases where rapid economic growth is achieved and living standards improve, certain products in these countries become increasingly affordable. This is a desirable outcome for most products—but not for tobacco, alcohol, and similar harmful products because their consumption generates substantial negative externalities (Jha et al., 2000). Therefore, if income growth is not followed by at least a proportional increase in real cigarette prices, cigarettes become more affordable, and a decrease in consumption—one of the two primary goals of tobacco taxation policy—is less probable. Consequently, an increase in taxes adjusted only by

inflation rates but not by changes in income will not be sufficient to discourage tobacco consumption (Blecher, 2020). Affordability is a very important tobacco control metric and a useful input for tax policy makers since it provides insight into whether an increase in cigarette prices is sufficient to reduce consumption.

The concept of affordability has been incorporated into the most important policy reports covering global tobacco control issues. The Guidelines for Implementation of Article 6 of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) (2014) suggest that national taxation policies should consider both income and price elasticity of demand for tobacco products to make them less affordable. Thus, periodic re-evaluation of tax levels is considered necessary. The World Bank (2018) recommends occasional sharp increases in specific excises that would have a dramatic impact on smokers' behavior. In the meantime, excise increases should exceed—or at least keep pace with—changes in affordability, ensuring that tobacco products are becoming less affordable over time.

There are several methods that can be applied to analyze tobacco affordability and provide time and cross-country comparisons, depending on the available data. The most popular one is relative income price (RIP) (Blecher & van Walbeek, 2004), which calculates affordability as a percentage share of GDP per capita required to purchase

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100 packs of cigarettes (2,000 cigarette sticks). Higher RIP means lower affordability of cigarettes and vice versa. When using the RIP method, it is critical to determine adequate cigarette price approximation since results could differ significantly when using various measures such as the price of the most popular brand (e.g., Marlboro), weighted average price, or lowest available price (Blecher, 2020).

As for the income approximation, GDP per capita is often used, which enables international comparability. Although wages provide a more precise measure of income, they are rarely used due to lack of available data. International comparisons require using the same definition of price and income as well as converting nominal into real values to account for inflation. Precise affordability comparisons should account for differences in purchasing power parity (PPP), since tobacco prices are expressed in common currency (often US$) using different exchange rates that are also influenced by different political and economic factors. These issues create the additional challenge of calculating an adequate PPP conversion factor, which some authors solve using international US$. Nevertheless, affordability comparisons are in general more reliable over time within a country, rather than among countries and should be therefore taken cautiously.

A second approach used to analyze affordability is the minutes of labor (MoL) method, which calculates affordability as the number of minutes of work required to buy a pack of Marlboro or a local brand (Guindon et al., 2002). The main issue with calculating affordability using the MoL method is the lack of comparable income data. This problem could be avoided using the price of a Big Mac as a reference value (Scollo, 1996; Lal & Scollo, 2002). Additionally, several modifications of the MoL method have been developed such as cigarette price daily income (CPDIR), used by Kan (2007), which calculates affordability as the ratio of the price of cigarettes to daily income, estimated as a mean salary for seven occupations with the lowest average salary in a specific country.

Finally, a third approach, the tobacco affordability index (TAI), estimates the impact of tobacco taxation policies on tobacco product prices and affordability as well as the impact of changes in affordability on tobacco consumption (Krasovsky, 2012). With TAI, affordability is calculated as the real annual change in GDP divided by the (inflation-adjusted) tobacco price increase. A negative TAI value indicates that tobacco products became less affordable compared to the base year.

This research aims to analyze trends in the cigarette affordability in ten selected SEE countries (five Western Balkan (WB) countries: Albania, Bosnia and Herzegovina (BiH), Montenegro, North Macedonia, and Serbia; and five European Union (EU) members: Bulgaria, Croatia, Hungary, Romania and Slovenia) and assess whether

these changes have been followed by respective changes in consumption. The countries were selected for the following two reasons. First, WB countries have excessive tobacco prevalence rates which are considerably higher if compared to those in the EU (WHO, 2019a). Their prevalence rates are more similar to those observed in the neighboring EU member countries, being also the latest that entered the EU[1]. Second, this research aims to analyze whether the EU accession of the five analyzed EU member countries that was related to adopting more strict tobacco control regulative including mandatory excise policy and institutional development, has resulted in lower tobacco consumption compared to the rest of the sample. Additionally, affordability trends in each of the ten analyzed countries are disaggregated to investigate to what level they have been affected by the change in price and/or income. Since no similar research has been conducted in the SEE region, the results of this research will provide valuable insights for future tobacco control policy measures by assessing the benefits of including affordability as an additional criterion when developing effective excise policies.

In addition to providing background for the research, the introductory section includes analysis of the most important empirical contributions in analyzing global tobacco affordability changes as well as GDP and cigarette price trends in selected SEE countries over the last decade. The second section explains econometric models used to assess whether affordability changes in the observed countries were followed by respective changes in tobacco consumption—known as affordability elasticity estimation. The third section provides a discussion of the results. Finally, the fourth section highlights conclusions and provides specific policy recommendations for tax policy makers in SEE countries.

Literature review

Most studies of cigarette affordability analyze affordability changes over time and provide cross-country comparisons, especially comparisons among countries belonging to different income groups (low-, middle- and high-income countries). For the purposes of this study, the most relevant research aims to estimate affordability elasticity by assessing the causal impact of affordability on tobacco consumption (Blecher & van Walbeek, 2004; He et al., 2018).

Blecher and van Walbeek analyzed the affordability of cigarettes in 70 countries (28 high-income and 42 low- and middle-income countries) over the period 1990–2001 using the RIP method. Their results suggest that overall, cigarettes are more affordable in

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[1] Slovenia and Hungary entered the EU in 2004, Bulgaria and Romania in 2007, and Croatia in 2013

high-income countries. In the observed period, affordability of cigarettes increased in 11 out of 28 high-income countries and 24 out of 42 low- and middle-income countries. Cross-sectional analysis indicates that a one-percent reduction in affordability results in a 0.49–0.57 percent decrease in consumption.

Similarly, applying the RIP method He et al. (2018) analyzed affordability in 16 low-income countries, 19 lower-middle-income countries, 13 upper-middle-income countries and 30 high-income countries. Affordability (the independent variable) was calculated using the lowest price from the Economist Intelligence Unit. For consumption, they used the consumption of cigarettes per capita in sticks. Comparison of local prices expressed in US$ was done using the PPP conversion factor. Their results confirmed relatively higher but decreasing affordability of cigarettes in upper-middle-income and high-income countries since 2001, which was followed by a decrease of consumption per capita. For low- and lower-middle-income countries the opposite trend was observed—lower but rising affordability. Consumption in those countries had an increasing trend until 2007 for low-income countries and 2009 for lower-middle-income countries. Affordability elasticity of demand was estimated at 0.2, which means that a ten-percent

increase in RIP results in a two-percent decrease in consumption per capita. Comparing affordability of different priced brands (cheapest, most sold, and premium) between the Eastern Mediterranean Region (EMR) and the rest of the world, Gordon et al. (2020) found that the historic and persisting higher affordability in EMR could be a reasonable explanation for the tobacco prevalence trends. They confirmed that, despite some convergence trends, affordability of each of the three price groups in EMR was, on average, lower when compared to the rest of the world.

Guindon et al. (2002) analyzed 87 countries and 56 cities over the period 1990–2000. To avoid the problem of price comparisons the authors used a price index for Big Macs, previously proposed by Lal and Scolo (1996),[2] and obtained similar results as Blecher and van Walbeek. In general, high-income countries have higher but decreasing affordability, whereas affordability in lower-income countries has seen an increasing trend. Kan (2007) obtained data for 60 cities worldwide and applied the cigarette-price-to-daily income ratio. He concluded that the affordability of cigarettes in most of the analyzed cities, particularly those in high-income countries, is relatively high, leaving significant space for tax increases. Krasovsky (2012) used the TAI to estimate the impact of tobacco taxation

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[2] Lal and Scolo developed the Big Mac Index to test cigarette affordability changes in 30 countries. They developed "Big Mac PPP" as the exchange rate that would result in the same

price of hamburgers in each country and calculated the quantity of cigarettes that could be bought with the amount of local currency required to buy one Big Mac hamburger.

policies on tobacco product prices and affordability as well as the impact of changes in affordability on tobacco consumption in Baltic countries for the period 2004–2011. Since Baltic countries experienced high growth rates over the first decade of the 21st century, Krasovsky adjusted tobacco price increases, calculated as the ratio of the consumer price index of tobacco to the overall consumer price index, to income changes (GDP growth per capita). Research results provided evidence to support the importance of measuring affordability as a key factor influencing tobacco consumption. In the recession period, the decrease in tobacco affordability resulted in a significant decline in consumption. However, in times of high economic growth Krasovsky argued that a moderate tax increase does not reduce affordability, as only a sharp increase in taxes could outweigh income growth (Krasovsky, 2012).

To our knowledge, there are no analyses of affordability of cigarettes in the SEE region and the WB region in particular. The only estimates of affordability trends in the region have been provided within the World Bank Global Tobacco Control Program briefs conducted in Serbia and Montenegro (Marquez et al., 2019, 2019a). As for Serbia, analysis has shown that affordability over the period 2008–2018 had a clearly decreasing trend with 2015 as an exception when tobacco products became more affordable (TAI increased by 5.5 percent). Since 2016, although

cigarette prices have increased at a faster pace compared to income, the real price increase has been low to moderate, having no significant impact on affordability. Unlike in Serbia, the government of Montenegro instituted a policy of "price shocks," which occurred over the period 2011–2012 and in 2017, significantly reducing the affordability of cigarettes. Since 2017, the growth of tobacco prices in Montenegro has occurred at almost the same pace as real income.

Trends in GDP and real cigarette prices in ten SEE countries

This research focuses on tobacco affordability changes in ten SEE countries, five of which are WB countries—Albania, BiH, Montenegro, North Macedonia, and Serbia—which are not yet members of the EU, and all at different phases of EU accession. The rest of the analyzed countries are EU members that entered the EU at different points of time over the last 17 years: Hungary and Slovenia in 2004, Romania and Bulgaria in 2007, and Croatia in 2013. With regard to the latest World Bank income classification of the countries (World Bank, 2020), seven analyzed countries are classified as upper-middle income (Albania, BiH, Montenegro, North Macedonia, Serbia, Bulgaria and Romania), whereas the other three (Slovenia, Hungary and Croatia) belong to the group of high-income countries (requiring a gross national income per capita of at least

US$ 12,695 in 2020 using the World Bank Atlas method[3]).

During the period 2000–2016 all observed countries experienced a dynamic average annual growth rate compared to the average for the 28 (at the time) EU member countries (EU-28). This growth contributed to the acceleration of these economies' attempts to catch up with their higher-income counterparts, particularly before the global financial crisis of 2008–2009. However, they still significantly lag behind the "old" EU members. To illustrate, Slovenia, as the most developed out of the analyzed economies, recorded a real GDP per capita level of 82.1 percent of the EU-28 average in 2016, followed by Hungary (70.6 percent) and Croatia (60 percent). WB economies, on the other hand, were clearly below 50 percent of the EU-28 GDP average, with Albania and BiH holding the last place (31.2 percent of the EU-28 average) (Zuk & Savelin, 2018).

Socioeconomic reforms in these countries and gradual economic integration have resulted in substantial living standard improvements, measured by GDP growth per capita (Figure 1). However, there is still significant room for growth to achieve economic convergence with higher-income countries, particularly if WB economies are considered (Sanfey et al., 2016). Recorded GDP growth rates in the WB countries over the last decade have not indicated convergence trends with other SEE countries. In the period 2008–2020, the studied SEE countries recorded relatively similar growth rates. Romania and Albania achieved the highest average annual growth of around 2.3 percent, whereas Croatia and Slovenia recorded the slowest growth with -0.3 and 0.6 percent, respectively. Convergence prospects in future years will depend on the status of reforms around structural competitiveness (innovation, institutional development, and demographic trends) as well as the pace of the EU integration of WB countries. To achieve sustainable growth and improve population health, governments must maintain the effectiveness of tobacco taxes by ensuring at a minimum that increases keep pace with economic growth.

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[3] The World Bank Atlas method - detailed methodology, https://datahelpdesk.worldbank.org/knowledgeb ase/articles/378832-what-is-the-world-bank-atlas-method

Figure 1. Real annual GDP growth per capita, 2008–2020 (in %)
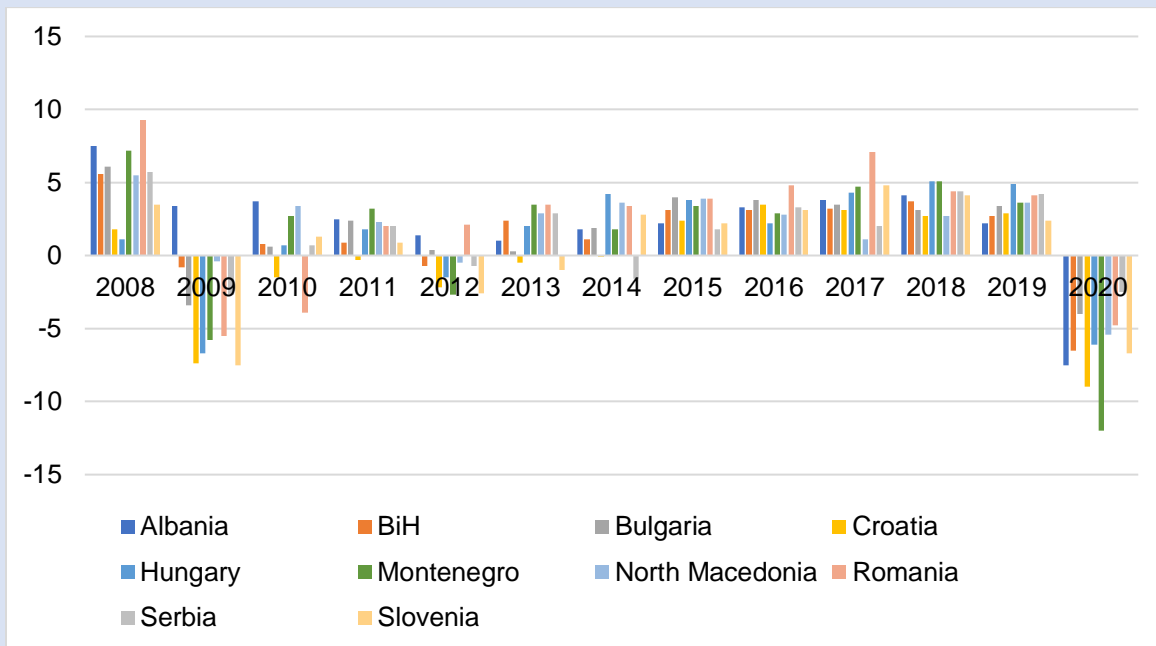
Source: *International Monetary Fund (IMF)*

Real prices of the most-sold cigarette brands have increased in all observed countries over the period 2008–2018. The most dynamic growth was recorded in Montenegro, where cigarettes became almost three times more expensive over the ten-year period. Prices also increased significantly in BiH (142 percent) and Serbia (130 percent).

On the other hand, real prices in North Macedonia and Bulgaria grew only by about 17 and 40 percent, respectively (Figures 2 and 3). Overall, real cigarette prices experienced dynamic growth over the first post-crisis years during the period of economic recovery (2010–2014), after which trends stabilized (2016–2018).

Figure 2. Real prices of the most-sold cigarette brands, 2008–2018 (2017 IMF international $)
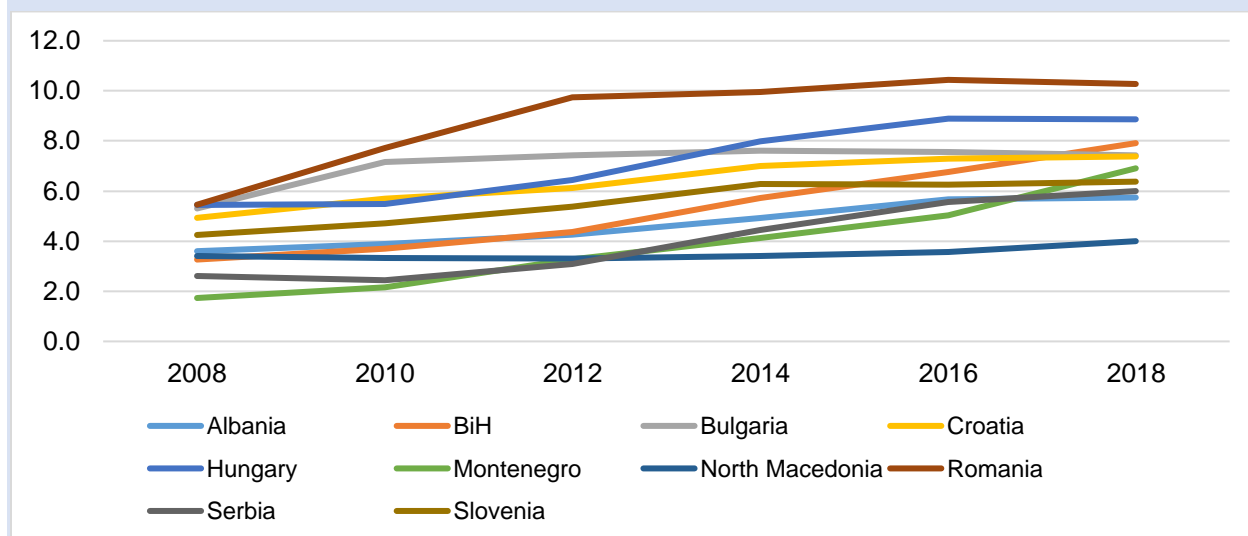
Source: Authors' calculations using the WHO and IMF data

Note: WHO GHO biannual data on retail prices for a pack of 20 cigarettes expressed in local currency converted to the international 2017 US$ using IMF World Economic Outlook database

Figure 3. Real prices of the most-sold cigarette brands, 2008 vs. 2018 (2017 international $)
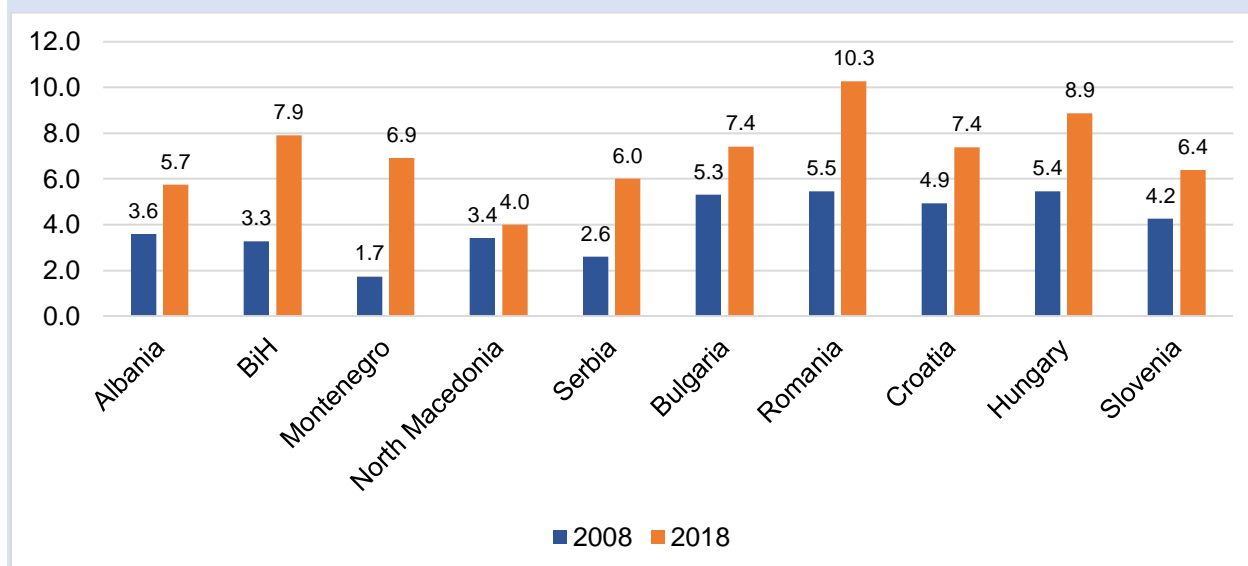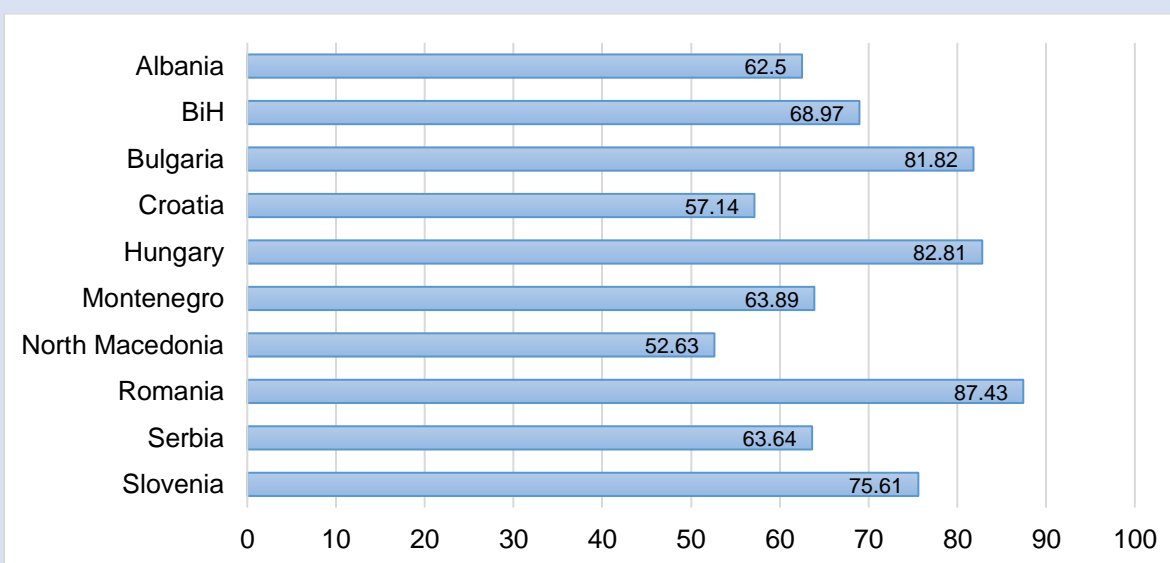

Source: Authors' calculations using WHO and IMF data

Note: WHO GHO biannual data on retail prices for a pack of 20 cigarettes expressed in local currency converted to the international 2017 US$ using IMF World Economic Outlook database

Another important metric related to affordability is price dispersion, which measures the share of the cheapest cigarette brand price in the premium brand price. Price dispersion is determined by the structure of taxes—another factor influencing affordability—in addition to the tax levels and the pricing strategies of the companies. A high proportion of the ad valorem tax component results in a relatively high dispersion of tobacco prices. Consequently, despite increasing tax rates, markets could be flooded with relatively cheaper tobacco brands that are affordable to the low-income population. As per the latest WHO data (2018), price dispersion among these SEE countries (Figure 4) is the highest in Croatia, where the share of the cheapest brand price in the premium brand price is lowest (57.14 percent). Conversely, price dispersion is the lowest in Romania, where the share is highest (87.43 percent).

Figure 4. Share of cheapest brand price in premium brand price in 2018 (%)

Country	Value
Albania	62.5
BiH	68.97
Bulgaria	81.82
Croatia	57.14
Hungary	82.81
Montenegro	63.89
North Macedonia	52.63
Romania	87.43
Serbia	63.64
Slovenia	75.61

Source: WHO GHO data repository

Despite a noticeable trend of rising cigarette prices, it should be underscored that taxes still have been used insufficiently as a tobacco control measure for two reasons: First, the tobacco industry has been increasing the "net of tax price," transferring more than the full amount of excise tax increases to consumers.[4] Second, although levels of consumption have

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[4] "Net of tax price of cigarettes" has continuously increased over time. For more details on increasing net-of tax prices in the region see: Vladisavljevic, M., Zubović, J., Đukić, M., & Jovanović, O. (2020). Tobacco price elasticity in Serbia: Evidence from a middle-income country

with high prevalence and low tobacco prices. *Tobacco Control, 29*(Suppl 5), s331-s336. and Marquez, P. V., Krasovsky, K., & Andreeva, T. (2019). Serbia – overview of tobacco use, tobacco control legislation and taxation.

steadily decreased over the last two decades in SEE countries, they are significantly higher than in most EU countries, while tax levels are still below the benchmarks recommended by the EU Directive (2011/64) and the WHO FCTC, Article 6.

Methodology

Another important contribution of this research is in its analysis of the relationship between affordability and consumption in these ten selected SEE countries for the period 2009–2019 (Model 1) and 2008–2018 (Model 2). To assess the relationship between changes in affordability and consumption of tobacco products, we applied a methodological framework that consists of two building blocks:

- Computation of appropriate affordability measures for the selected SEE countries and time period covered as suggested by the literature: TAI (Krasovsky, 2012) and RIP (Blecher & van Walbeek, 2004).

- Specification of two econometric models that assess the impact of TAI (Model 1) and RIP (Model 2) on cigarette consumption per capita. The econometric models follow the approach applied in research conducted by Blecher and van Walbeek (2004) and He et al. (2018).

The following data were used:

- Consumption – for the EU countries consumption per capita

was calculated according to European Commission data on annual consumption of cigarettes divided by the population (EUROSTAT); for the non-EU countries per capita consumption was calculated using national Household Budget Survey (HBS) data.

- Prices – consumer price index (CPI) of tobacco and Harmonized Index of Consumer Prices (HICP) are retrieved from the national statistics and EUROSTAT database.

- RIP – percent share of GDP per capita required to purchase 100 packs of 20 cigarettes of the most sold brand, retrieved from WHO Global Health Observatory (GHO) data.

- Income – annual GDP per capita growth retrieved from the IMF's World Economic Outlook (WEO) data.

- Unemployment – share of unemployed people in total labor force retrieved from the World Bank's World Development Indicators (WDI) database.

- MPOWER scores are retrieved from WHO reports and data sets. They refer to six tobacco control policy dimensions: M - monitor tobacco use, P - protect people from smoke, O - offer help to quit, W - warn about the dangers of tobacco, E - enforce bans on tobacco marketing, and R - raise

taxes on tobacco. The "M" policy dimension score value ranges from 1 to 4, whereas other components range from 1 to 5 (1 refers to missing data, 2 is the weakest and 5 the strongest policy). Since WHO collects MPOWER data on a biennial basis missing values are linearly interpolated, so they may contain measurement error.

As suggested by Krasovsky (2012), we computed TAI by combining data on GDP per capita growth and price indices according to the formula:

$$TAI = GDP\ per\ capita\ growth\ *\ (CPI\ overall\ /\ CPI\ for\ tobacco) - 100.$$

The definition of TAI implies that if TAI_1 < 0 affordability is decreasing and vice versa. RIP values for selected countries are available (WHO, 2021), but only biennially. For this reason, we interpolated the missing values following observed trends in available RIP data. This certainly produced some measurement errors in the RIP time series; however, the existence of clear trends in RIP dynamics (Figure 5) implies that measurement errors are most likely random in nature and therefore do not severely affect the reliability of the econometric estimation. Since the computed TAI values are more precise and reliable relative to RIP values, which are prone to measurement errors, Model 1 using TAI as an explanatory variable is considered as a baseline, whereas Model 2 using RIP is estimated as an alternative for the purpose of comparison.

Within Model 1 (Eq. 1), we applied TAI as an aggregate affordability measure. As previously mentioned, it was developed by Krasovsky (2012) and widely used by the World Bank for assessing affordability trends at the national level (see Marquez et al., 2019, 2019a). Since TAI is defined as a rate of change in affordability, change of cigarette consumption per capita is applied as a dependent variable rather than a nominal value. A negative TAI value means that tobacco became less affordable and tobacco consumption is expected to decrease, which implies an expectation that TAI and consumption covary in the same direction (positive regression coefficient). The Model 1 reads as follows (*i* and *t* refer to country and year, respectively):

$$Annual\ percentage\ change\ of\ cigarette\ consumption\_it = a0 + a1*TAI\_it + a2*X\_it + e\_it \qquad (1)$$

Annual percentage change of cigarette consumption is defined as the change in cigarette consumption (in cigarette sticks) per adult (15+ years old) for the country i in year t. As for the covariates (X_it), we used unemployment rate, as in He et al. (2018), and MPOWER components (Appendix Table A3), as applied by Ngo et al. (2017) and He et al. (2018). The MPOWER components are applied one at a time to preserve degrees of freedom. The disturbance term e_it is assumed to contain both individual effects and random error.

For comparisons, the alternative model, Model 2 (Eq. 2), is applied.

Within Model 2, RIP was applied as an alternative affordability measure. It refers to the share of GDP per capita required to purchase 100 packs of the most popular cigarette brand in a specific country (WHO biennial data for the period 2008–2018). Higher RIP indicates lower affordability, which implies an expectation that RIP and consumption covary in opposite directions (negative regression coefficient). Since both RIP and consumption are strictly positive values, the model is specified in log-log form so that the estimated regression coefficient can be interpreted as elasticity of affordability. Model 2 reads as follows:

$$InCigarette\ consumption\_it = a0 + a1*lnRIP\_it + a2*X\_it + e\_it \qquad (2)$$

Cigarette consumption is defined as cigarette consumption (in sticks) per adult (15+ years old) for the country i in year t. RIP is defined as the percent share of GDP per capita required to purchase 100 packs of cigarettes (price of 100 packs of cigarettes of most-sold brand / GDP per capita); higher RIP indicates lower affordability. Model 2 applies the same covariates as Model 1, with unemployment rate and MPOWER components added subsequently (one per specification).

Because the number of observations is limited and panels are most likely correlated (since the SEE countries share common macroeconomic and development trends), a rigorous procedure of panel econometric analysis was applied to ensure reliability of the results. Special attention was given to heteroskedasticity, serial correlation and cross-sectional dependency, which are issues typically present in panel data regression analysis.

Results

Analysis based on TAI shows that change in affordability strongly depends on income changes. Following the onset of the global crisis in 2009, all analyzed countries except Albania experienced GDP per capita decreases, which influenced sharp decreases in tobacco affordability (Table 1). However, as soon as the global economy started

recovering (2011–2012) tobacco affordability stabilized and even increased in North Macedonia and Bulgaria. Episodes of sharp affordability decreases due to policies recommended by WHO and the World Bank were quite rare, occurring only in Montenegro (2012 and 2019), Serbia and BiH (2013–2014) and Hungary (2012–2013).

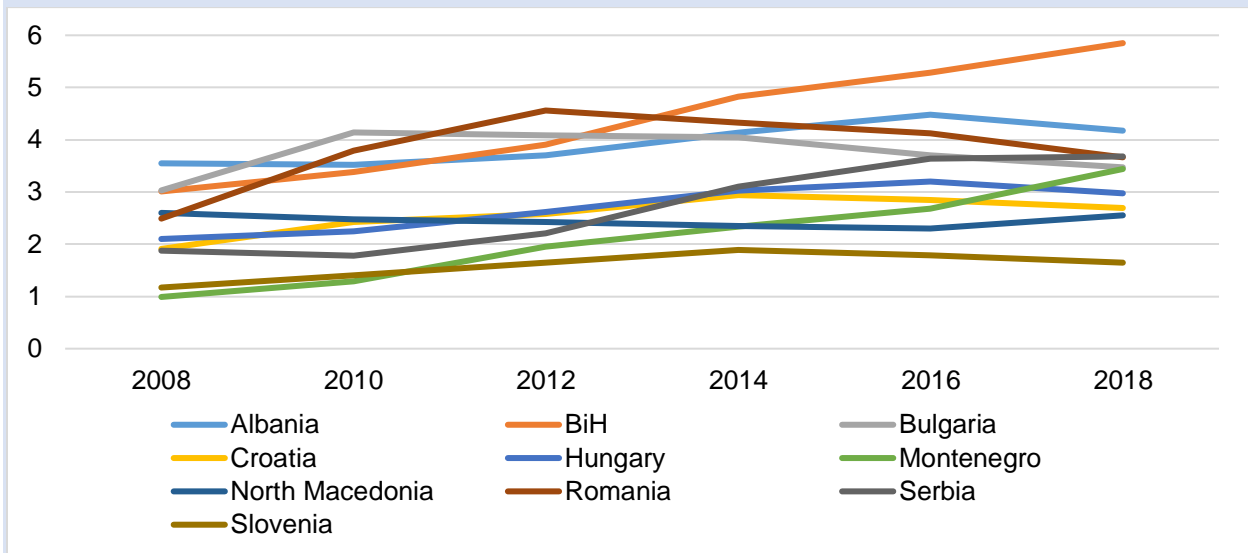**Table 1. Trends in TAI, 2009–2020 (percent)**

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ALB	1.15	-0.88	-9.86	-1.42	-4.63	-7.19	0.74	5.46	4.90	2.24	3.32	0.49
BiH	n.a.	n.a.	-5.66	-10.87	-5.47	-10.44	-3.89	-5.87	-2.31	-3.89	-3.40	n.a.
BUL	-19.33	-21.46	2.52	3.43	0.92	-0.25	2.78	0.31	3.15	1.93	4.78	-3.78
CRO	-19.10	-2.63	-5.90	-3.10	-8.43	-6.82	0.76	3.59	2.83	1.81	-1.21	-11.06
HUN	-10.88	-3.62	9.01	-14.15	-12.29	-8.88	0.63	-1.21	-0.11	0.49	-2.95	-11.16
MKD	-0.93	3.50	4.02	1.21	2.90	-0.59	-3.78	-3.57	-5.55	-2.21	-3.04	-4.54
MNE	n.a.	n.a.	n.a.	-19.14	-5.56	-3.61	2.85	-1.04	-4.23	-17.26	10.77	-5.47
ROM	-20.33	-27.41	-1.46	0.44	-1.63	-2.01	-0.99	-0.06	5.98	2.92	0.82	-8.55
SLO	-12.42	-6.08	-3.98	-6.83	-7.71	-1.52	-1.24	2.92	2.59	4.95	2.68	-8.64
SRB	-13.87	-4.62	-3.44	-7.57	-14.05	-11.92	6.04	-4.23	-2.80	-0.66	-0.75	-5.86

Source: Authors' calculations using national statistics and EUROSTAT data

As per WHO data for 2018, affordability—measured by the share of GDP required to buy 2,000 cigarettes of the most-sold brand—is the highest in Slovenia and North Macedonia with 1.65 and 2.55 percent of GDP per capita, respectively (Figure 5). The lowest affordability is observed in BiH and Albania, with 5.85 percent and 4.17 percent of GDP per capita, respectively. Affordability trends recorded relatively different patterns over the observed period. After recording relatively strong decreases in affordability, 3.44 percent of GDP was required to buy 2,000 cigarettes in Montenegro in 2018, compared to 0.99 percent in 2008. Similar trends are observed in BiH, where the price of 2,000 cigarettes in 2008 accounted for 3.55 percent of GDP and 5.85 percent in 2018. With the exception of North Macedonia, decreases in affordability in 2018 compared to 2008 are observed in all other countries (Figure 6).

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Figure 5. Trends in RIP, 2008–2018 (percent)

Source: WHO, Global Health Observatory data

Figure 6. Trends in RIP, 2008 vs. 2018 (percent)
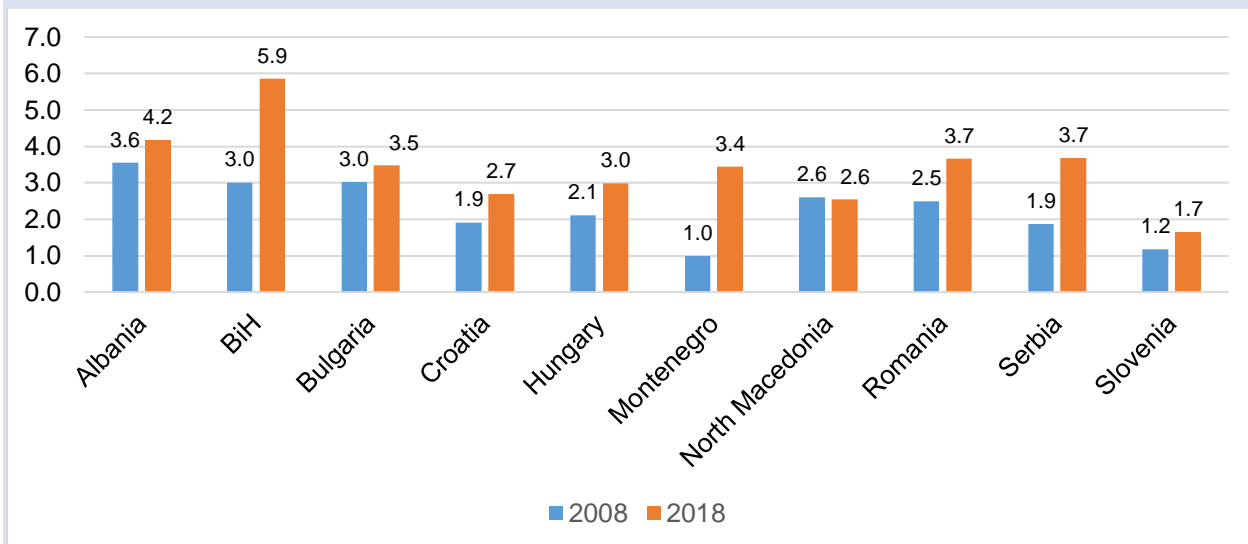
Source: WHO, Global Health Observatory data

Model 1 (TAI) and Model 2 (RIP) are estimated using a fixed effects (FE) estimator, which produces consistent estimates as long as explanatory variables are not endogenous. Tables 2 and 3 present the estimation results for Model 1 and Model 2, respectively.

Model 1 results confirm the positive relationship between the tobacco affordability index and consumption. The impact of affordability on cigarette consumption is estimated at 1.1719, indicating that a decrease in affordability (measured by TAI) by one percentage

point results in a 1.2 percentage point decrease in the annual consumption. Model 1 shows that the effects of other tobacco control policies, both individually and in aggregate, are negligible compared to the effects of affordability. The same holds for unemployment. The estimated explanatory power of Model 1 implies that variations in TAI explain around 33 percent of variation in cigarette consumption per capita.

Table 2. The effects of cigarette affordability on per capita consumption (Model 1)

	TAI	M	P	O	W	R	mpower	l_unemp
TAI	1.1719***	1.1466***	1.1297***	1.2502***	1.2016***	1.1354***	1.1537***	1.1300***
	(0.1512)	(0.1571)	(0.1444)	(0.1513)	(0.1383)	(0.1475)	(0.1444)	(0.1651)
M		2.6818						
		(3.5121)						
P			1.4799					
			(1.7566)					
O				7.7970				
				(6.0455)				
W					-2.3169			
					(2.1317)			
R						-3.1801		
						(3.4335)		
Mpw							0.5749	
							(1.3567)	
l_unemp								-2.9597
								(3.6946)
_cons	-0.8844**	-9.6800	-5.9532	-31.6067	6.1554	13.6218	-13.7361	6.3504
	(0.3866)	(11.4490)	(5.9978)	(23.9436)	(6.2130)	(15.7749)	(30.2660)	(9.0302)
No. of Obs.	88	88	88	88	88	88	88	88
R-	0.33	0.34	0.34	0.36	0.34	0.34	0.33	0.33

Source: Authors' calculations

Notes: Standard errors in parentheses: *p<0.1, **p<0.05, ***p<0.01; the "E" component of MPOWER is omitted due to lack of variation

Estimated results for Model 2 provide even more robust evidence of the impact of affordability on cigarette consumption (Table 3). In particular, the estimated explanatory power of Model 2 is almost twice as high as Model 1, implying that variations in RIP explain around 62 percent of variation in cigarette consumption per capita. Table 3 demonstrates that affordability elasticity is estimated at around -1.1 (a decrease in affordability by one percent results in a decrease of consumption by 1.1 percent). Again, neither the effects

of unemployment nor the effects of other tobacco control policies approximated with MPOWER components proved to be significant.

Table 3. The effects of cigarette affordability on per capita consumption (Model 2)

	lnRIP	M	P	O	W	R	mpower	l_unemp
lnRIP	-1.1225***	-1.1644***	-1.1222***	-1.1277***	-1.1364***	-1.0922***	-1.1259***	-1.1402***
	(0.2412)	(0.2677)	(0.2419)	(0.2400)	(0.2346)	(0.2284)	(0.2454)	(0.2432)
M		0.0455						
		(0.0816)						
P			-0.0012					
			(0.0182)					
O				0.0038				
				(0.0714)				
W					-0.0505			
					(0.0386)			
R						-0.0425		
						(0.0897)		
Mpw							0.0014	
							(0.0087)	
l_unemp								-0.0452
								(0.0865)
_cons	8.5444***	8.4429***	8.5479***	8.5351***	8.7089***	8.7060***	8.5178***	8.6762***
	(0.2556)	(0.2603)	(0.2687)	(0.3407)	(0.3055)	(0.4899)	(0.2978)	(0.3411)
No. of	101.00	101.00	101.00	101.00	101.00	101.00	101.00	101.00
R-	0.62	0.63	0.62	0.62	0.63	0.62	0.62	0.62

Source: Authors' calculations

Note: Standard errors in parentheses: *p<0.1, **p<0.05, ***p<0.01; the "E" component of MPOWER is omitted due to lack of variation

The common OLS assumptions of non-correlated and homoscedastic random errors are usually violated in panel regression models, which can undermine reliability of the results stemming from the FE estimation (as the FE estimation is essentially an OLS estimation applied to panel data after the so-called within-transformation). The results of the appropriate residual tests (Appendix Table A1) clearly indicate the presence of heteroskedasticity, correlation and cross-sectional dependency in both models. Therefore, for the purpose of a robustness check feasible generalized least squares (FGLS) and panel-corrected standard errors (PCSE) are used as alternative estimators to the FE estimator. They are more robust to heteroskedasticity, correlation and cross-sectional dependence of residuals but also more

sensitive to the small number of observations (88 and 101 for Model 1 and Model 2, respectively). Results obtained by applying alternative estimators confirm the robustness of the primary results (Appendix Table A2). Furthermore, in the case of Model 2, the alternative estimations provide results in line with previous research estimating affordability elasticity between -0.75 (FGLS) and -0.77 (PCSE).

Conclusions

The concept of cigarette affordability is based on the premise that the impact of price on consumption of cigarettes should be considered only in combination with income, since real price increases could be insufficient to discourage consumption in periods of economic prosperity. This is particularly relevant for low- and middle-income countries showing economic growth potential, and having relatively weak institutions, including under-developed non-price tobacco control mechanisms. Previous studies showed an increasing trend in affordability in these countries, which therefore suggests they failed to reduce consumption as a result (Gordon et al., 2020; He et al., 2018; Blecher, 2010). The WB countries lag behind the most developed EU economies in terms of economic development. Implementation of successful institutional reforms in these SEE countries would improve living standards, making the issue of cigarette affordability particularly relevant.

In this research, we analyzed affordability trends of cigarettes in ten SEE countries (five EU members and five WB countries) aiming to detect causal impacts of affordability on consumption of cigarettes over the period 2009–2019 (Model 1) and 2008-2018 (Model 2). To our knowledge, this research provides the first evidence on the effects of affordability changes on consumption in the selected countries. We followed methodology applied by Blecher and van Walbeek (2004) and He et al. (2018). Two regression models were specified to assess the impact of affordability on consumption of cigarettes. In Model 1 for the explanatory variable, we applied an aggregate index that calculates affordability as TAI. In Model 2, the explanatory variable refers to the percentage of GDP per capita required to buy 100 packs of the most popular brand (RIP), extracted from the WHO GHO database.

The results indicate that the affordability of cigarettes decreased in all observed countries except in North Macedonia. However, affordability decreases using the RIP approach over the period 2008–2018 range from around 247 percent in Montenegro to 15 percent in Bulgaria. Both employed models provide evidence in favor of affordability as the main determinant of tobacco consumption. Model 1 shows that a decrease in affordability (measured by TAI) by one percentage point results in a 1.2 percentage point decrease in annual consumption. Model

2 estimates affordability elasticity at around -1.1, indicating that a decrease in affordability by one percent results in a decrease in consumption by 1.1 percent, which is even more robust compared to Model 1.

In both models we used as covariates unemployment and tobacco control policies approximated with MPOWER indicators, both individually and in aggregate. In line with previous research, the results confirmed that the effects of other control policies and unemployment are negligible compared to affordability. A potential explanation for these results could be the lack of variation among MPOWER indicators.

An affordability trend analysis shows that changes in affordability predominantly follow income changes (approximated with GDP growth per capita) as opposed to price changes influenced by taxation policy. In the recession period (2009) affordability decreased in all observed countries. However, in periods of economic growth, affordability trends were stable or even increased (2017–2018). This could be expected since, with the exception of inflation adjustments, the observed countries do not take into account affordability when designing their taxation policies. In line with previous research, the results we obtained applying two econometric models clearly confirm that affordability is the most important determinant of tobacco consumption. However, estimated regression coefficients including the affordability elasticity

obtained in Model 2 (-1.1) are considerably higher compared to those found by Blecher and van Walbeek (2004) and He et al. (2018), who estimated elasticity between -0.49 and -0.57 and at -0.2, respectively. This could be explained by relatively shorter time series data used within this study.

In sum, given the obtained results, affordability should be the paramount consideration when designing tobacco taxation policies. Therefore, in line with WHO and World Bank recommendations, we propose the following two policy changes, which could result in significant improvements for the overall effectiveness of tobacco control policy in the SEE region:

1. Use of tobacco affordability indicator when designing tobacco taxation policy with an aim to monitor annual affordability changes. The tobacco affordability indicator should monitor not only price changes of the most popular brands but also other relevant prices such as price of the cheapest brand and brands of relevant alternative tobacco products (such as roll-your-own tobacco).

2. In countries that apply a tobacco excise calendar policy, such calendars should be reformed by including the affordability index, which would prevent increases in affordability of tobacco products in periods of high economic growth.

Although this research did not confirm their significant influence on consumption compared to affordability, other policies (MPOWER) should not be neglected when designing effective tobacco control policy. There are many policy evaluations that confirm the effectiveness of well-designed comprehensive tobacco control programs, and some which also show that the effects of tobacco taxation are often enhanced when part of such programs (Wakefield & Chaloupka, 2000). Despite relatively low variations in MPOWER scores among the observed countries, there is plenty of room for further improvements in implementation of non-price tobacco control policies, particularly in BiH, Montenegro, and Serbia, where policies still fall short of meeting WHO recommendations.

References

Blecher, E. (2020). *Affordability of tobacco products: The case of cigarettes*. Tobacconomics White Paper. Chicago, IL: Tobacconomics, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago, 2020.

Blecher, E. H., & van Walbeek, C. P. (2004). An international analysis of cigarette affordability. *Tobacco Control, 13*(4), 339-346.

Blecher, E. H., & van Walbeek, C. P. (2009). Cigarette affordability trends: an update and some methodological comments. *Tobacco Control, 18*(3), 167-175.

Chaloupka, F. J., Yurekli, A., & Fong, G. T. (2012). Tobacco taxes as a tobacco control strategy. *Tobacco Control*, *21*(2), 172-180.

European Union. (2010). COUNCIL DIRECTIVE 2010/12/EU of 16 February 2010: amending Directives 92/79/EEC, 92/80/EEC and 95/59/EEC on the structure and rates of excise duty applied on manufactured tobacco and Directive 2008/118/EEC. *Official Journal of the European Union*, 50, 1–7.

European Union. COUNCIL DIRECTIVE 2011/64/EU, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:176:0024:0036:EN:PDF

Gordon, M. R., Perucic, A. M., & Totanes, R. A. P. (2020). Cigarette affordability in the Eastern Mediterranean Region. *Eastern Mediterranean Health Journal*, 26(1).

He, Y., Shang, C., & Chaloupka, F. J. (2018). The association between cigarette affordability and consumption: An update. *PLoS One*, *13*(12), e0200665.

Ho, L. M., Schafferer, C., Lee, J. M., Yeh, C. Y., & Hsieh, C. J. (2018). Raising cigarette excise tax to reduce consumption in low- and middle-income countries of the Asia-Pacific region: A simulation of the anticipated health and taxation revenues impacts. *BMC Public Health, 18*(1), 1-9.

Husain, M. J., Kostova, D., Mbulo, L., Benjakul, S., Kengganpanich, M., & Andes, L. (2017). Changes in cigarette prices, affordability, and brand-tier consumption after a tobacco tax increase in Thailand: Evidence from the Global Adult Tobacco Surveys, 2009 and 2011. *Preventive Medicine*, 105, S4-S9.

Jha, P., Musgrove, P., Chaloupka, F. J., & Yurekli, A. (2000). The economic rationale for intervention in the tobacco market. In: P. Jha & F. J. Chaloupka, Eds., *Tobacco control in developing countries* (pp. 153–174). Oxford University Press.

Jovanovic, O., Zubović, J., Vladisavljević, M., Bodrož, D., Ljumović, I., Domazet, I., & Đukić, M. (2018). Estimation of tobacco products price and income elasticity using aggregate data. *Economic Analysis, 51*(3-4), 81-94.

Kan, M. Y. (2007). Investigating cigarette affordability in 60 cities using the cigarette price–daily income ratio. *Tobacco Control*, *16*(6), 429-432.

Krasovsky, K. (2012). Tobacco taxation policy in three Baltic countries after the EU accession. *Tobacco Control and Public Health in Eastern Europe, 2*(2), 81-98.

Kostova, D., Chaloupka, F. J., Yurekli, A., Ross, H., Cherukupalli, R., Andes, L.,^ Asma, S.. (2012). A cross-country study of cigarette prices and affordability: Evidence from the Global Adult Tobacco Survey. *Tobacco Control*, 23(1), e3-e3

Lal, A., & Scollo, M. (2002). Big Mac index of cigarette affordability. *Tobacco Control*, *11*(3), 280-282.

Marquez, P. V. Krasovsky, K., & Andreeva, T. (2019). *Serbia – overview of tobacco use, tobacco control legislation and taxation* (English). WBG Global Tobacco Control Program Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/499321560881630381/Serbia-Overview-of-Tobacco-Use-Tobacco-Control-Legislation-and-Taxation

Marquez, P. V., Krasovsky, K., & Andreeva, T. (2019a). *Montenegro – overview of tobacco use, tobacco control legislation and taxation* (English). WBG Global Tobacco Control Program Washington, D.C.: World Bank Group. http://documents1.worldbank.org/curated/en/646321561400173562/pdf/Montenegro-Overview-of-Tobacco-Use-Tobacco-Control-Legislation-and-Taxation.pdf

Ngo, A., Cheng, K. W., Chaloupka, F. J., & Shang, C. (2017). The effect of MPOWER scores on cigarette smoking prevalence and consumption. *Preventive Medicine*, 105, S10-S14.

Radosavljević, G., Babin, M., Erić, M., & Lazarević, J. (2020). Income convergence between Southeast Europe and the European Union. *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu, 38*(2), 499-519.

Sanfey, P., Milatovic, J., & Kresic, A. (2016). *How the Western Balkans can catch up*. European Bank for Development and Reconstruction.

Savedoff, W., & Alwang, A. (2015). *The single best health policy in the world: tobacco taxes*. Center for Global Development policy paper 62.

Scollo, M. (1996). The Big Mac index of cigarette affordability. *Tobacco Control*, *5*(1), 69.

Vladisavljevic, M., Zubović, J., Đukić, M., & Jovanović, O. (2020). Tobacco price elasticity in Serbia: evidence from a middle-income country with high prevalence and low tobacco prices. *Tobacco Control*, *29*(Suppl 5), s331-s336.

Wakefield, M., & Chaloupka, F. (2000). Effectiveness of comprehensive tobacco control programmes in reducing teenage smoking in the USA. Tobacco control, 9(2), 177-186.

World Bank. (2020). *World Bank country and lending groups.* https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

World Health Organization. (2011). *WHO report on the global tobacco epidemic, 2011: Warning about the dangers of tobacco.*

World Bank. (2012). *Economics of Tobacco Taxation Toolkit*. World Bank Global Tobacco Control Program. Washington DC: World Bank. https://untobaccocontrol.org/taxation/e-library/wp-content/uploads/2018/05/2018-IDN-Tobacco-Excise-Assessment_20180402.pdf

World Health Organization. (2013). *WHO report on the global tobacco epidemic, 2013: Enforcing bans on tobacco advertising, promotion and sponsorship*.

World Health Organization (2014). *WHO Framework Convention on Tobacco Control.* https://www.who.int/fctc/text_download/en/

World Health Organization. (2015). *WHO report on the global tobacco epidemic, 2015: Raising taxes on tobacco*.

World Health Organization. (2017). *WHO report on the global tobacco epidemic, 2017: Monitoring tobacco use and prevention policies.*

World Health Organization. (2019). *WHO report on the global tobacco epidemic, 2019: Offer help to quit tobacco use*.

World Health Organization. (2019a). European tobacco use: Trends report 2019. Geneva: WHO.

World Health Organization. (2021). *The Global Health Observatory*. https://www.who.int/data/gho

Zubović, J., Jovanović, O., Đukić, M., Jolović, N., & Vladisavljević, M. (2020). *Adult tobacco consumption in Serbia, 2019*. Institute of Economic Sciences, Belgrade, Serbia.

Żuk, P., & Savelin, L. (2018). *Real convergence in Central, Eastern and South-eastern Europe*. ECB occasional paper 212.

Appendix

Table A1. Residual tests

Models	1 - TAI			2 - RIP		
Tests	Statistics	Value	p-value	Statistics	Value	p-value
Modified Wald test for heteroskedasticity H0: Residuals are homoscedastic	chi2 (10)	386.15	0	chi2 (10)	121.63	0
Wooldridge test for serial correlation in panel data H0: Residuals are not serially correlated	F(1, 9)	31.302	0	F(1, 9)	14.243	0.0044
Pesaran's test of cross-sectional independence H0: Residuals are not cross-panel correlated	z	2.937	0.0033	z	-0.458	0.647

Source: Authors' calculations

Table A2. Alternative estimator results: feasible generalized least squares (FGLS) and panel-corrected standard errors (PCSE)

	Model 1	Model 2
PCSE	1.2255***	-0.7726***
FGLS	1.2152***	-0.7553***

Source: Authors' calculations

Note: *p<0.1, **p<0.05, ***p<0.01

Table A3. MPOWER aggregate scores[1]

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Albania	22.23	22	22.58	23	22.93	23	23.28	24.5	23.63	23	23.98
BiH	17.53	17.5	17.87	18	18.23	19	18.58	18.5	18.93	19	19.28
Bulgaria	22.70	21.5	23.50	25.5	24.30	25.5	25.10	25.5	25.90	25.5	26.70
Croatia	18.28	20.5	19.53	18	20.78	21.5	22.03	22.5	23.28	24.5	24.53
Hungary	21.93	20	22.48	25	23.03	24.5	23.57	23.5	24.13	23.5	24.68
Montenegro	18.98	17.5	19.43	21.5	19.88	20.5	20.33	21	20.78	20	21.23
North Macedonia	18.33	19.5	19.47	19.5	20.63	21	21.78	22	22.93	24	24.08
Romania	22.13	23.5	22.68	22	23.23	22	23.78	25.5	24.33	24.5	24.88
Serbia	22.40	23	22.40	21.5	22.40	22.5	22.40	22.5	22.40	22.5	22.40
Slovenia	21.83	22.5	21.78	22	21.73	20.5	21.68	20.5	21.63	23	21.58

[1] Since WHO collects MPOWER data on a biennial basis missing values are linearly interpolated, so they may contain measurement errors.

Source: WHO, Reports on Global Tobacco Epidemic