Cigarette Consumption and Affordability in Bosnia and Herzegovina, 2010–2023

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Abstract

Background

The increase in cigarette affordability in recent years in Bosnia and Herzegovina has likely contributed to higher smoking rates, as economic growth and disposable income have outpaced tobacco tax increases. Regardless of the efforts made until 2019 to reduce consumption through increased tobacco excise taxes, cigarette prices remain low, particularly compared to the European Union. The post-COVID-19 economic shifts, including a significant rise in gross domestic product (GDP) and inflation with minimal cigarette price increases, further highlight the need for stronger tobacco control measures that address both price and income dynamics.

Methodology

This study applies quarterly macroeconomic data from 2010 to 2023 to examine cigarette consumption and affordability in Bosnia and Herzegovina. Employing time series analysis on macro data, this research assesses the impact of key affordability indicators on cigarette consumption across different income groups. The current analysis aims to evaluate the effectiveness of tax and price increases in curbing cigarette consumption through estimations of price, income, and affordability elasticity.

Results

The analysis of affordability trends reveals a downward trend up until 2020, followed by a reversal in direction thereafter. A 10-percent increase in income would lead to an increase in cigarette consumption by 5.87 percent, while a 10-percent increase in price and relative income price would decrease cigarette consumption by 8.85 and 9.67 percent, respectively. To reduce consumption by 10 percent, an increase in the specific excise tax of 37–44 percent is needed, which would raise tax revenue from the specific excise by 27–34 percent.

Conclusions

Since there was no increase in specific excise tax rates for five years (2020–2024), while the Consumer Price Index (CPI) and GDP growth were high, substantial increases in excise taxes and changes in tobacco control policies are necessary to reduce the affordability and thus the demand for cigarettes.

JEL Codes: I18, H25, C22, E31, D12

Keywords: tobacco taxation, tobacco control policies, cigarette consumption, affordability of cigarettes, Bosnia and Herzegovina

Tables and Figures

Table 1. Data and Definitions 12
Table 2. Measures of Affordability 15
Table 3. Estimations results, Model 1 28
Table 4. Estimation results (Model 2.2, and Model 2.5) 31
Table 5. Simulations 33
Table A1. Unit root tests 32
Table A2. Johansen cointegration test, Model 1 33
Table A3. Postestimation, Model 1 33
Table A4. Johansen cointegration test, RIP – based on ANW, Model 2 34
Table A5. Estimations results, RIP based on ANW, Model 2 34
Table A6. Postestimation, RIP based on ANW, Model 2 35
Table A7. Johansen cointegration test, RIP - MSold and DI, Model 2 36
Table A8. Estimations results, RIP based on DI, Model 2 36
Table A9. Postestimation, RIP based on DI, Model 2 37

Figure 1. Price of most-sold category (MSold) from Q1 2010 to Q4 2023 in BAM 14
Figure 2. RIP based on ANW, by income groups 20
Figure 3. RIP trends, based on ANW and DI, for all income groups 21
Figure 4. TAI, based on ANW, by income groups 22
Figure 5. TAI, based on ANW and DI for all income groups 23
Figure 6. MoL for the cheapest and most-sold price category, by income groups 24
Figure 7. MoL for the cheapest and most-sold price category 25
Figure 8. IPC, based on ANW, by income groups 26
Figure 9. IPC, based on ANW and DI 27

Introduction

Cigarette affordability is one of the central factors influencing smoking behavior in Bosnia and Herzegovina (BiH)–a country where economic growth has often outpaced the effects of tobacco taxation–leading to consistently high smoking rates as well as smoking intensity. As an upper middle-income country with significant disparities in income distribution, BiH faces the challenge of decreasing tobacco use in conditions of relatively affordable tobacco for a large portion of the population. The relationship between cigarette prices and disposable income is crucial, as it directly impacts the affordability of cigarettes, which in turn drives consumption patterns.

Tobacco control policy in B&H at the state level is based on the following regulation:

- Law on Excise Duties in BiH, adopted in 2009 (Official Gazette of BiH, no. 49/09, 49/14, 60/14, 91/17 and 50/22) regulates tobacco taxation.
- Law on Tobacco of Bosnia and Herzegovina, adopted in 2010 (Official Gazette of BiH, no. 32/10), which regulates definitions of tobacco, tobacco production, processing and manufacturing of tobacco products, as well as tobacco manufacturers.
- Code on Commercial Communications, adopted in 2016, (Official Gazette of BiH, no. 3/16) prohibits all forms of commercial communications related to cigarettes and other tobacco products, guns, firearms and pyrotechnical means, as well as opium drugs.

According to the Law on Excise Duties (2010), cigarette prices are subject to an ad valorem tax, a specific excise tax, and a value-added tax (VAT). These taxes were increased from 2009 until 2019 when the specific excise tax reached 0.84 EUR per pack of 20 cigarettes. Despite these measures, cigarettes prices remained low compared to many European Union (EU) countries, making these products very affordable. In 2023, the weighted average retail sales price was 5.98 EUR in the EU (Tax Foundation Europe, 2024) and only 2.99 EUR in BiH.

The high affordability in BiH is reflected in the high smoking prevalence, which was 41 percent in 2019, with a significant portion of smokers consuming more than 20 cigarettes per day (Gligorić et al., 2023). The smoking epidemic in BiH underscores the need for more effective tobacco control measures, particularly in terms of pricing and taxation.

The impact of economic growth on cigarette affordability was further intensified by the COVID-19 pandemic, followed by substantial increases in GDP and overall consumer prices, which were not followed by an increase in tobacco prices. The IMF reports that the average inflation rate, as measured by the overall CPI, has risen by 3.9 percent over the past four years. During the same period, the GDP per capita growth rate, measured in constant national currency, averaged two percent annually (IMF, 2024). If cumulative indicators are observed, in the period 2020–2023 prices increased by 22 percent, real GDP increased by 10.5 (IMF, 2024), while cigarette prices increased by 12 percent (Indirect Taxation Authority – ITA, 2024). This disparity has increased cigarette affordability, making it easier for consumers to maintain or even increase their tobacco consumption. The high income elasticity of demand for cigarettes in BiH, estimated at 0.81 (Gligorić et al., 2022), indicates that as incomes rise, the demand for cigarettes increases significantly, further complicating efforts to reduce smoking rates through taxation alone.

Given these challenges, it is essential to consider a multifaceted approach to tobacco control in BiH that includes both price-based measures and non-price interventions, such as public health campaigns and smoking cessation programs. The effectiveness of these measures depends on a deep understanding of the complex relationship between cigarette affordability, income, and consumption patterns.

This study explores the cigarette affordability trends in BiH from 2010 to 2023, providing insights into the effectiveness of current tobacco control policies and offering recommendations for future strategies. The paper is structured as follows: section two reviews the relevant literature; section three describes the methodological approach; section four presents the results of the study; section five discusses these results; section six outlines the study's main limitations, and the final section summarizes the key conclusions and provides policy recommendations.

Literature Review

This literature review examines global trends in cigarette consumption and affordability, synthesizing findings from multiple studies on tobacco control, pricing policies, and economic factors that influence cigarette affordability and consumption patterns. The review focuses also on the impact of fiscal policies, particularly taxation, on cigarette affordability and discusses the broader public health implications of these trends.

Guindon et al. (2002) conducted a comprehensive analysis of global trends in cigarette prices and affordability, employing the minutes of labor (MoL) method, which measures the minutes of labor required to purchase a pack of cigarettes (the cheapest or the most sold). Their findings indicate that while cigarettes have become less affordable in most developed countries, they remain more affordable in many developing nations. The study highlights the significant potential for increasing tobacco taxes worldwide, which could reduce consumption and improve public health outcomes.

Expanding on this, Blecher and Van Walbeek (2004) conducted a foundational study on international trends in cigarette affordability using the relative income price (RIP) method. They found that rising taxes in about 60 percent of high-income countries made cigarettes less affordable, while economic growth in about 57 percent of low- and middle-income countries outpaced price increases, leading to greater cigarette affordability. This study underscored the importance of maintaining high excise taxes to counteract the effects of rising incomes on affordability.

In their later study, Blecher and Van Walbeek (2008) expanded their analysis by examining the relationship between cigarette affordability and consumption trends globally. They confirmed the importance of affordability as a determinant of smoking rates and emphasized that consistent fiscal measures are critical for reducing smoking prevalence. Using RIP and MoL as affordability metrics, they reported a dichotomy between high-income and low- and middle-income countries: cigarettes had become less affordable in most high-income countries, but more affordable in developing economies. This study highlighted a concerning trend: since 2000, affordability in low- and middle-income countries has been increasing rapidly, threatening global tobacco control efforts.

Further contributing to this field, Blecher and Van Walbeek (2009) published a study that built on these findings but also introduced significant methodological refinements. The authors compared two primary measures: RIP, which calculates the percentage of per capita GDP required to purchase 100 packs of cigarettes, and MoL, which measures the time required for a median-wage worker to earn enough to purchase a pack of cigarettes. They provided evidence that RIP is the more appropriate measure for low- and middle-income countries, as it captures broader economic dynamics, while MoL may be more suitable for high-income countries, where income inequality plays a lesser role. The 2009 study also introduced methodological improvements, including handling outliers, addressing data inconsistencies caused by hyperinflation, and extending the dataset to cover 1990–2006 with additional countries. These refinements ensured that affordability measures were more reliable and comparable across contexts.

In terms of results, the 2009 paper confirmed the trends observed in earlier studies but offered additional precision. For example, while the 2008 paper noted the rapid rise in affordability in developing countries, the 2009 study quantified this trend more rigorously, showing that affordability increased at a median annual rate of seven percent between 2003 and 2006 in low- and middle-income countries and that cigarettes became less affordable in only 14 percent of them. Furthermore, the 2009 study revealed that in countries where cigarettes became less affordable, real price increases were the primary driver, while affordability gains in other countries were overwhelmingly due to rapid income growth outpacing price increases.

Blecher et al. (2013) focused on trends in cigarette affordability across Europe, particularly in the context of EU-wide tax policies affecting new member states. Analyzing data from 37 European countries, they concluded that EU accession is followed by significant increases in excise taxes and cigarette prices, especially in new member states. The study underscores the role of coordinated tax policies in reducing cigarette affordability and smoking rates across Europe. Krasovsky (2012) examined the impact of tobacco taxation on cigarette affordability in Ukraine, using the RIP method to assess changes over time. Despite significant tax increases, the findings suggest that cigarettes remain relatively affordable. The study highlights the importance of continuous tax adjustments to account for economic changes and effectively reduce smoking rates.

Appau et al. (2017) investigated the economic impacts of tobacco taxation and cigarette affordability in low- and middle-income countries (LMICs) in sub-Saharan Africa. Their findings demonstrate that higher taxes can effectively reduce smoking rates. However, they caution that the overall impact of tax increases is often moderated by economic growth, which can make cigarettes more affordable if taxes are not adequately adjusted. The study calls for stronger fiscal policies to counteract the effects of rising incomes in LMICs.

Zheng et al. (2018) conducted a study on cigarette affordability in Indonesia, using the RIP method. Despite rising cigarette prices, their findings reveal that cigarettes have become more affordable due to rapid income growth. The authors recommend implementing higher taxes to counteract this trend and reduce smoking rates, particularly among low-income groups. In a similar study, Zheng (2017b) assessed the impact of tobacco control policies on cigarette affordability in China, employing multiple methods, including RIP. Their findings indicate that while these policies have made cigarettes less affordable, ongoing economic growth may undermine these efforts unless tax rates are continually adjusted. The authors emphasize the need for sustained fiscal vigilance to maintain the effectiveness of tobacco control measures.

Nargis et al. (2019) focused on the impact of tobacco taxes on smoking behavior in China. Their study found that significant tax increases would lead to a reduction in smoking rates, particularly among low-income populations. Employing price elasticity and affordability elasticity measures, the authors concluded that regular adjustments of the (uniform) specific excise tax rate to inflation and per capita income growth are necessary to sustain progress in reducing smoking rates, as economic growth can offset the effects of tax-induced price increases. Furthermore, these authors stress that apart from general affordability, policy makers need to address affordability for specific groups, such as youth and low-income households, as those populations are most likely to be affected by price changes.

In a broader analysis, Nargis et al. (2021) examined the relationship between tobacco product prices, income, and affordability across 169 countries from 2007 to 2016, utilizing both price and affordability elasticity. They found that while price elasticity effectively predicts consumption changes in high-income countries, affordability elasticity serves as a better predictor in LMICs, where robust economic growth is common. The study emphasizes that affordability elasticity can be a critical benchmark for setting tobacco taxes in LMICs to effectively reduce tobacco consumption.

Nazar et al. (2021) reviewed the implementation and impact of tobacco control policies in the South-East Asia Region (SEAR), focusing on the effectiveness of taxation and public health campaigns. While they observed progress in reducing smoking rates, the authors noted challenges related to the affordability of tobacco products and inconsistent policy enforcement. The study calls for stronger regulatory measures and consistent enforcement to sustain public health gains.

Lastly, Zubović et al. (2024) examine cigarette affordability trends in 10 Southeastern European countries between 2008 and 2019, utilizing the RIP and the tobacco affordability index (TAI) as key measures. The findings reveal that cigarette affordability decreased on average across the region, with sharper declines in the Western Balkans compared to EU member states, driven by higher real price increases relative to income growth. The results indicate that declining affordability significantly reduces cigarette consumption, reinforcing the critical role of taxation policy. However, the study critiques existing policies in the region for failing to integrate affordability measures effectively, cautioning that future price increases must outpace income growth to sustain reductions in smoking prevalence

Overall, the literature finds a strong relationship between cigarette affordability and consumption globally. Fiscal policies, particularly taxation, have proven effective in reducing smoking rates, although their impact varies depending on the economic context and the strength of regulatory frameworks. The methods used to estimate cigarette affordability, such as RIP and MoL, are crucial for understanding these trends. In low- and middle-income countries, where economic growth can lead to increased cigarette affordability, maintaining high taxes is essential to curbing smoking rates. Future research should continue to explore these trends, focusing on the long-term health outcomes associated with reduced smoking prevalence and the role of fiscal policy interventions in different regions.

Data and Methodology

Data and sample

This study focuses on cigarette affordability and consumption in BiH from 2010 to 2023, using macroeconomic data from the Agency for Statistics of BiH, International Monetary Fund (IMF), World Bank (WB), and Indirect Taxation Authority of BiH (ITA). The data, along with their definitions, are presented in Table 1.

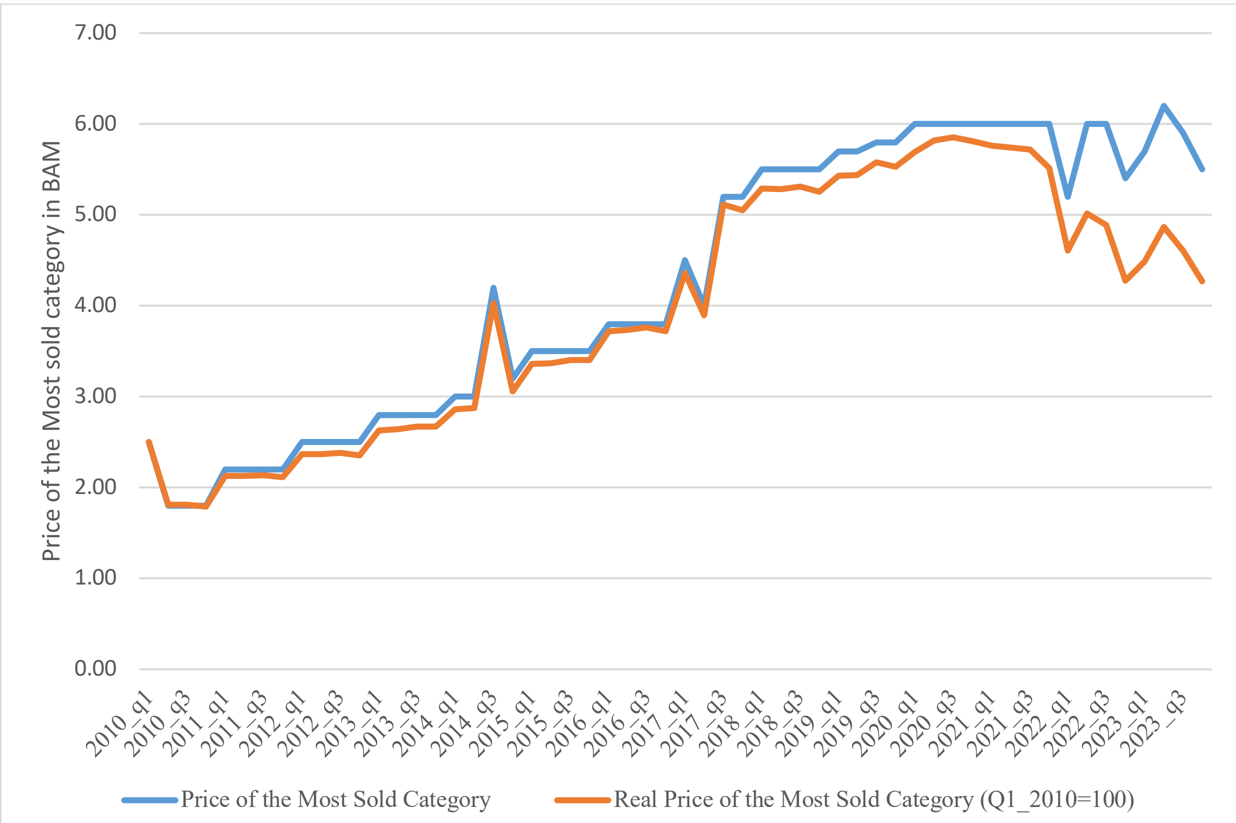
Table 1. Data and definitions

Data	Definition and source
Gross national disposable income per capita (DI)	The gross national disposable income (DI) is calculated according to IMF (2013) as follows: DI = C + I + G + CAB. Considering that the GDP data include net export figures, which are also contained in the current account balance (The Central Bank of Bosnia and Herzegovina, 2024), the net export component has been subtracted from the GDP value to obtain the data for C+I+G (The Agency for Statistics of BiH, 2024a). The data are provided quarterly, meaning the gross national disposable income for the three months is not an average value but rather the sum of the monthly gross national disposable income. The gross national disposable income per capita was calculated by dividing the

	DI by the population number (The Agency for Statistics of BiH, 2022).
Average net wages, by occupation (ANW)	Average net wages by occupation (ANW) refers to the average net payment for full-time jobs. Based on the ANW, we created the high-income group (HI), low-income group (LI), and middle-income group (MI). The data are presented quarterly, reflecting the average over three months. (The Agency for Statistics of BiH, 2024b).
Cigarette consumption (CS)	Cigarette consumption (CS) refers to the total number of packs purchased in one year, divided by the population number. The data are based on monthly information regarding the number of issued excise stamp marks and their corresponding prices. For this analysis, we used quarterly data (The Indirect Taxation Authority of Bosnia and Herzegovina, 2024)
Most-sold price category - MSold	The most-sold price category is the price of the most-sold quantity of cigarette packs, obtained based on the number of issued excise stamps.
Consumer Price Index (CPI)	The Consumer Price Index (CPI) refers to the average increase in consumer prices. For this analysis, we used quarterly data (The Agency for Statistics of BiH, 2024c).
Law on Tobacco (2010) (tob_low)	Binary variable, 1 for quarters after Q2 of 2010, 0 if otherwise. It is related to the adoption of the Law on Tobacco of Bosnia and Herzegovina (Official Gazette of BiH, no. 32/10).
Code on Commercial Communications (2016) (adv_ban)	Binary variable, 1 for quarters after Q1 of 2016, 0 if otherwise. It is related to the adoption of the Code on Commercial Communications (Official Gazette of BiH, no. 3/16).

The trend of the most-sold cigarette category over the specified period is illustrated in Figure 1, providing a visual representation of how the price of cigarettes has fluctuated. This figure shows that after abandoning the practice of annual excise tax increases in 2019, cigarette price continued to rise at a smaller rate, which mainly resulted in the profit margin growth of the tobacco industry. Since increases in cigarette prices were below the CPI growth rate, real prices entered a phase of decline, suggesting increasing affordability.

Figure 1. Price of most-sold category (MSold) from Q1 2010 to Q4 2023 in BAM



Source: Authors' calculations

Measures of Affordability

For measures of affordability, several indicators are used. To calculate RIP and TAI, disposable income (DI) and ANW are applied. The TAI is calculated based on the methodologies of Krasovsky (2012) and Đukić et al. (2021), with a slight modification. Instead of using GDP per capita, as done in the original studies, we use ANW and DI as the measures of income. In addition to RIP and TAI, we calculate affordability using the MoL, which measures the time required to purchase the cheapest pack of cigarettes (Guindon et al., 2002), and the income purchasing capacity (IPC), which assesses how many cigarettes can be purchased with per capita disposable income (Zheng et al., 2017). To calculate MoL, we consider the cheapest and the most-sold price category of cigarettes. For IPC, we follow Zheng et al. (2017) and use RDI and ANW instead of GDP per capita. Given the relatively high secondary income (unilateral transfers) received by BiH citizens from abroad, this measure serves as a good indicator of affordability. The measures of affordability, along with their definitions and formulas, are presented in Table 2.

Table 2. Measures of affordability

Measure	Definition	Formula
Relative income price (RIP)	The RIP is the percentage of per capita income needed to purchase 100 packs of twenty cigarettes.	RIP=100*Pi/I I = Income (DI, ANW, Low Income, High Income, Middle Income) Pi = Most-sold cigarette price category (MSold)
Tobacco affordability index (TAI)	The tobacco affordability index denotes the annual percentage change in affordability. TAI < 0 indicates decreasing affordability.	T I=ΔANW/(CPI/CPIcgrt)-100 ΔANW = Growth of the ANW CPI = Overall CPI CPIcgrt = Cigarette CPI TAI=ΔDI/(CPIcgrt/CPI) ΔDI = Growth of the DI
Minutes of labor (MoL)	Measures the minutes of labor, assuming 174 working hours within a month, required to purchase the cheapest and most-sold price category.	MoL=(CHP/ANW_h)*60 MoL=(MSold/ANW_h)*60 ANW_H = ANW per working hour CHP = Cheapest price category MSold = Most-sold price category
Income purchase capacity (IPC)	Measures how many cigarettes can be purchased with per capita disposable income.	IPC=I/Pi I = Income (DI, ANW, Low Income, High Income, Middle Income) Pi = Most-sold price category (MSold)

Methodology

In the first iteration, we display the trends in affordability measures. First, we present RIP and TAI trends for three income groups: low-, middle-, and high-income. We have designed the income groups based on the ANW by occupations. We began by ranking 19 occupations from highest to lowest ANW. Then we defined low-income group as the seven occupations with the lowest ANW, then the next seven occupations are defined as the middle-income group, and the five occupations with the highest ANW are defined as the high-income group.

For the first year of analysis, 2010, the ANW for the low-income group was 540 BAM, for the middle-income group 836 BAM, and for the high-income group 1163 BAM. For the last year of the analysis, 2023, the ANW for the low-income group was 984 BAM, for the middle-income group 1275 BAM, and for the high-income group 1696 BAM. Employees in the low-income group make up between 51 and 53 percent of total employment, while those in the middle- and high-income groups account for 24 and 23 percent, respectively.

In BiH, throughout the entire period, the ANW for the low-income group consistently remains below the national average. This indicates that at least 50 percent of employees are earning an ANW below the country's average. Affordability trends based on ANW are also shown for each income group. The affordability trend based on DI can only be presented for the entire sample since the data on disposable income per income group are not available. Next, we display trends for MoL and IPC in the same manner.

In the second iteration, we estimate the impact of affordability measures on cigarette consumption in BiH for the entire sample from 2010 to 2023. First, we will estimate two basic models using ordinary least squares (OLS) on the time series with quarterly data (Nargis et al., 2020). Several models are estimated, depending on control variables used in the basic models.

Model 1:

$$lnCS = \alpha_0 + \alpha_1 lnMSold + \alpha_2 lnI + \alpha_3 X_i + \varepsilon$$

where α_1 and α_2 represent the price and income elasticity of cigarette consumption, and α_1 is expected to be negative, implying a negative relationship between price and consumption by the law of demand, while α_2 is expected to be positive, implying that tobacco product is a normal good and the demand for tobacco products increases with income growth. The vector X refers to two binary control variables, adoption of the Law on Tobacco (2010) , and the Code on Commercial Communications (2016). While similar studies often include control variables such as the unemployment rate, composite MPOWER score, and population demographics, we could not incorporate these due to the lack of continuous data. The ε refers to the white noise, while I stands for the RDI or for the ANW.

Model 2:

$$lnCS = \beta_0 + \beta_1 lnRIP + \beta_2 lnI + \beta_3 X_i + \varepsilon$$

The coefficient β_1 represents the affordability elasticity of cigarette consumption, with the interpretations of the other control variable coefficients remaining consistent with those in Model 1. A negative value for β_1 is anticipated, signifying that as the proportion of income needed to buy 100 packs of cigarettes rises, affordability declines, resulting in reduced cigarette consumption. From an econometric perspective, Model 2 is a restricted version of Model 1, requiring the price and income elasticity parameters to be identical (Nargis et al., 2020). This suggests that if prices and income increase proportionally, consumption remains unaffected. Theoretically, this assumption aligns with the notion that the indirect utility function is homogeneous of degree zero in prices and income—implying that scaling both prices and income by the same factor does not alter the consumption bundle that maximizes utility. In such cases, there is no money illusion, and no change in consumption is expected. For price increases to lead to reduced consumption, the increase in prices must outpace that of income.

In the third iteration, we will conduct a simulation exercise for the entire sample to evaluate and forecast the effectiveness of tobacco control policies through tax and price increases. The following steps will be applied (Nargis et al., 2020):

1. The required percentage increase in price, MSold%, which is necessary to achieve the desired reduction of cigarette consumption, CS%, with income growth, I%, is based on Model 1:

$$MSold_{\%} = \frac{CS_{\%} - (I_{\%} * \alpha_2)}{\alpha_1},$$

where MSold denotes the most-sold price category.

2. To achieve the same reduction of cigarette consumption, CS%, based on Model 2, the required RIP% increase is given by:

$$RIP_{\%} = \frac{CS_{\%}}{\beta_1},$$

while the required price increase is given by:

$$MSold_{\%} = RIP_{\%} + I_{\%}.$$

3. Under the assumption that the tax increase is fully passed onto consumers, with the given initial tax burden, t%,[1] as a percentage of

[1]Not taking into account other pass-through scenarios.

MSold, the required increase in tax per unit of cigarette consumption, T%, would be given by:

$$T_{\%} = \frac{MSold_{\%}}{t_{\%}}.$$

4. The effect of the tax increase on actual consumption, C_a%, informed by affordability elasticity, would be given by:

$$C_{a\%} = P_{\%} * \alpha_1 + (I_{\%} * \alpha_2),$$

when Model 1 is valid (P% is from step 2). But, when Model 2 is valid, then the actual effect of the tax increase on consumption is given by:

$$C_{a\%} = RIP_{\%} * \beta_1,$$

where RIP% is from step 2.

5. The effect of the tax increase on revenue, R%, which is informed by affordability elasticity, is given by:

$$R_{\%} = T_{\%} + C_{a\%},$$

where T% is from step 3, and C_a% is from step 4.

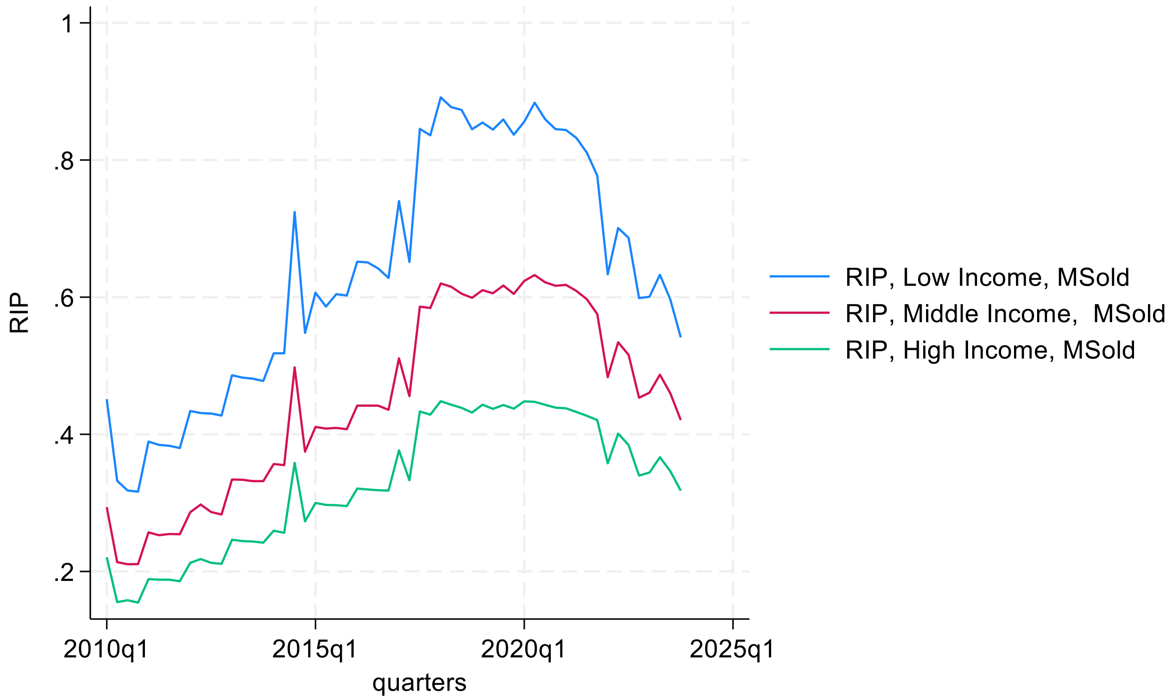
Results

Cigarette affordability trends

The RIP trends for the three income groups are shown in Figure 2. The affordability of the most-sold price category decreased during the period from Q1 2010 to Q4 2019. When comparing the three income groups, cigarettes are always more affordable for the high-income group compared to the middle- and low-income groups. Affordability increased sharply after the fourth quarter of

2019. In this case, the differences between the three income groups are more pronounced.

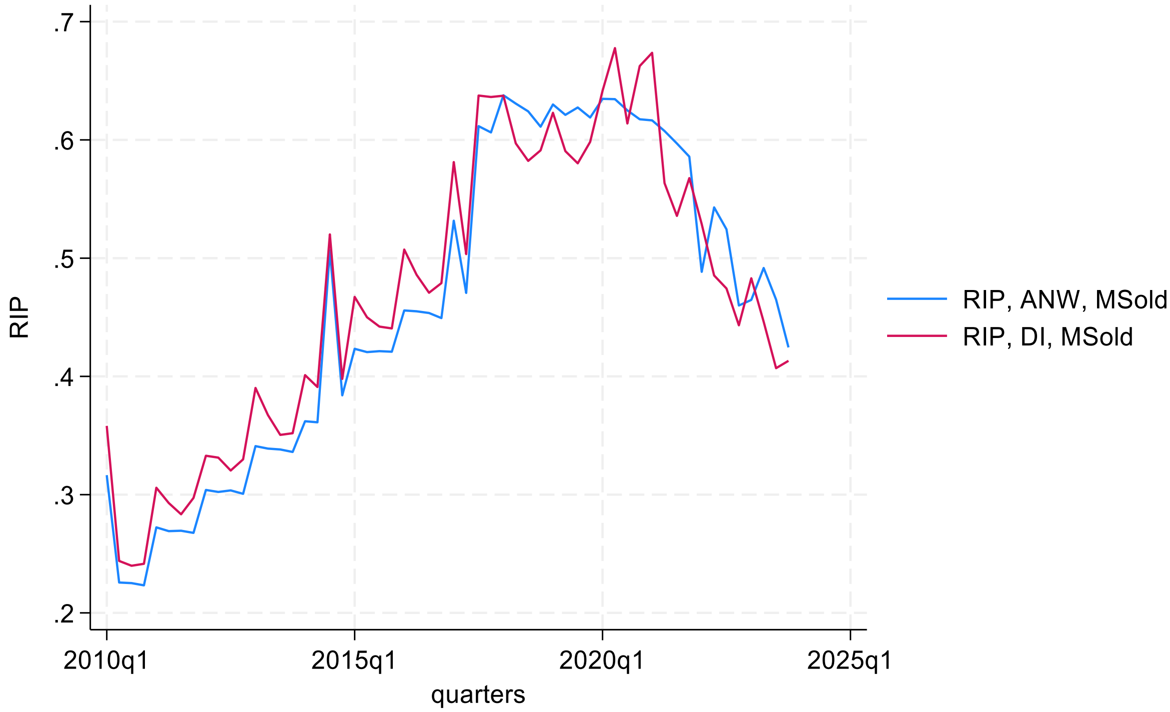
Figure 2. RIP based on ANW, by income groups



Source: Authors' calculations

The most-sold price category of cigarettes is most affordable for the high-income group, which experienced the smallest decrease in affordability, while it is the least affordable for the low-income group, which saw the largest decrease in affordability.

Figure 3. RIP trends, based on ANW and DI, for all income groups

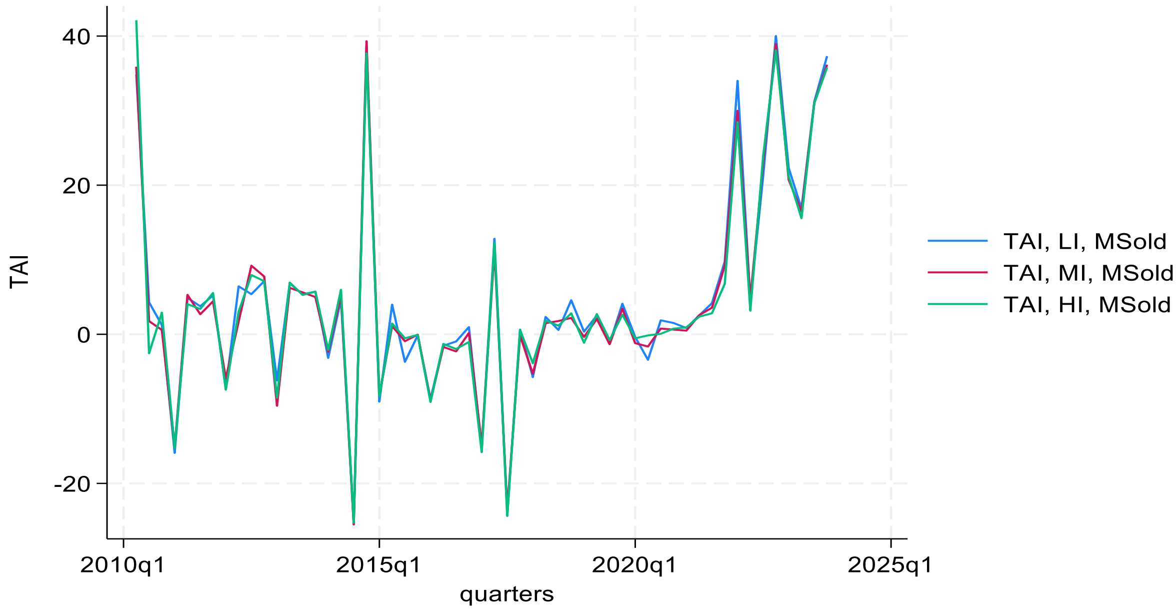


Source: Authors' calculations

Figure 3 presents the time series of RIPs (all population) calculated using proxies for income, ANW, and DI. The ANW represents the average net wage for three months, while DI for the three months is not an average value but rather the sum of the monthly gross national disposable income. For this reason, we have divided the quarterly DI by three in order to obtain an average monthly value for three months and to make the data comparable with ANW. Figure 3 conveys the same trend as the previous graphs: cigarette affordability decreased until the first quarter of 2020 when it sharply increased. There is almost no difference in affordability regardless of whether the RIP is calculated based on ANW and DI.

Figure 4 shows TAI by income groups, calculated based on the most-sold price category and ANW. We observe a clear trend of decreasing cigarette affordability, followed by a sharp increase after Q1 2020. It appears that there is no difference in affordability between the income groups.

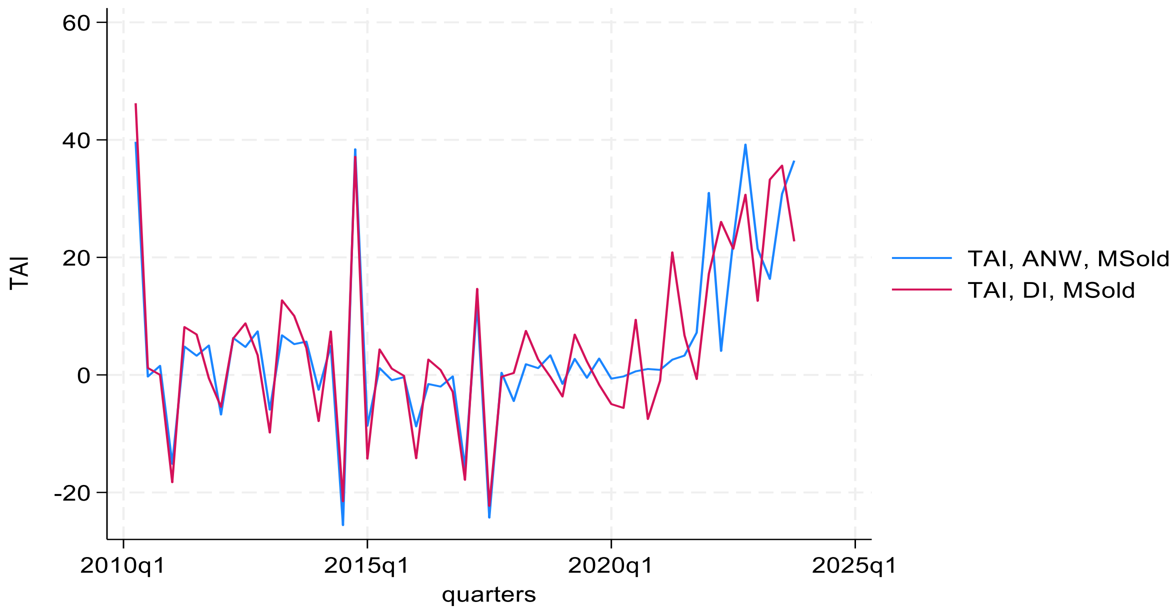
Figure 4. TAI, based on ANW, by income groups



Source: Authors' calculations

Applying both proxies for income, ANW and DI, the same conclusion is drawn as in the previous case, with no significant difference between the DI and ANW measures (Figure 5).

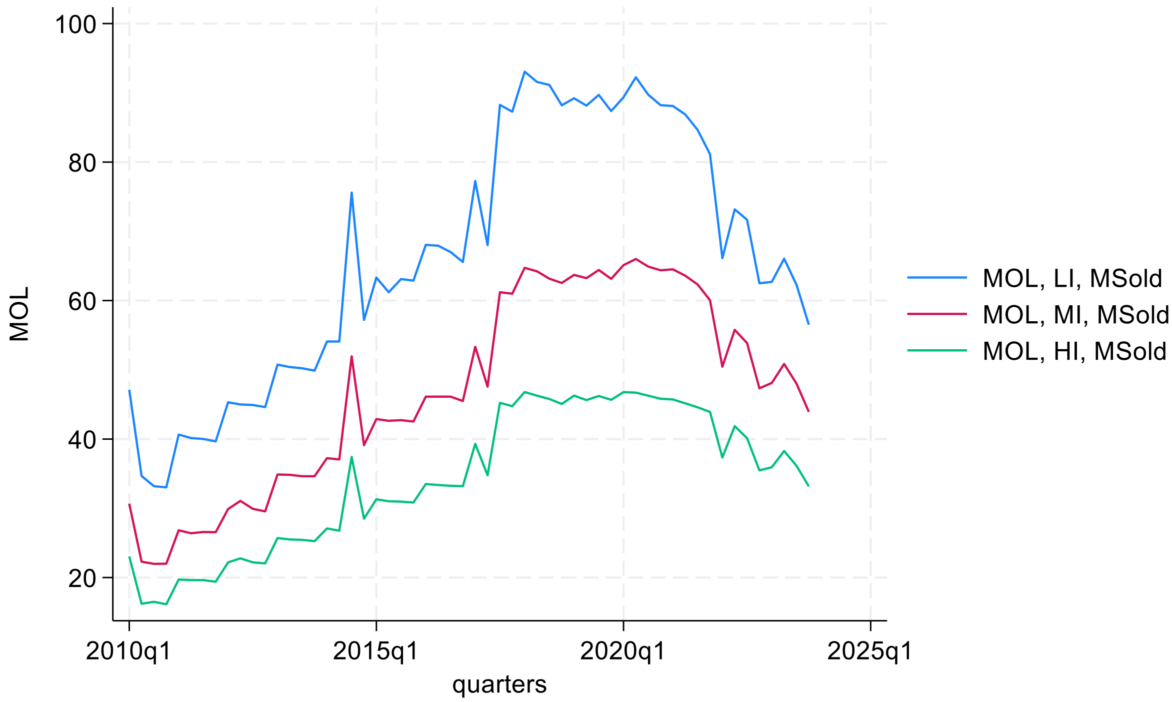
Figure 5. TAI, based on ANW and DI for all income groups



Source: Authors' calculations

Similar to the RIP measure, the MoL shows that, until Q4 2019, all three income groups needed to work more minutes to afford a pack of 20 cigarettes with an increasing trend of this indicator, but after that period the number of minutes required decreased. The high-income group needs to work less than 50 minutes to buy a pack of the most-sold cigarettes, while the low-income group needs to work between 80 and 90 minutes to buy a pack at the peak of the MoL measure (Figure 6).

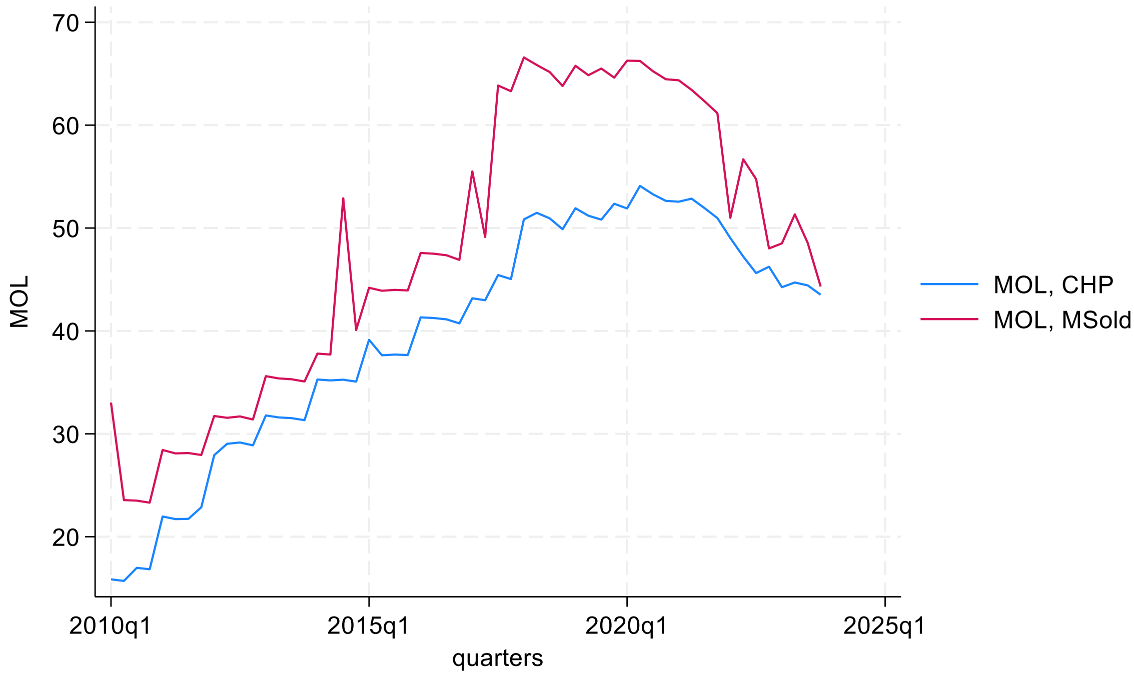
Figure 6. MoL for the cheapest and most-sold price category, by income groups



Source: Authors' calculations

A similar trend is found when estimating the MoL for the cheapest and most-sold price categories of cigarettes: an increasing number of minutes of work were required to buy a pack of 20 cigarettes by Q4 2019 (Figure 7). After this, the working time needed to purchase a pack sharply decreased. Interestingly, the MoL for the most-sold price category increased sharply compared to the cheapest price category around 2017, while still following the overall trend. The reason is probably the large oscillation in the most-sold price category. In Q3 2017, it increased from 4.5 BAM to 5.2 BAM, significantly exceeding the increase in the specific excise tax, which rose by only 0.15 BAM. With some fluctuations, it continued to rise, reaching 6 BAM in Q3 2022. In subsequent periods, the most-sold price category decreased slightly in some quarters while annual net wages increased—from an average of 973 BAM in Q1 2021 to 1,295 BAM in Q4 2023.

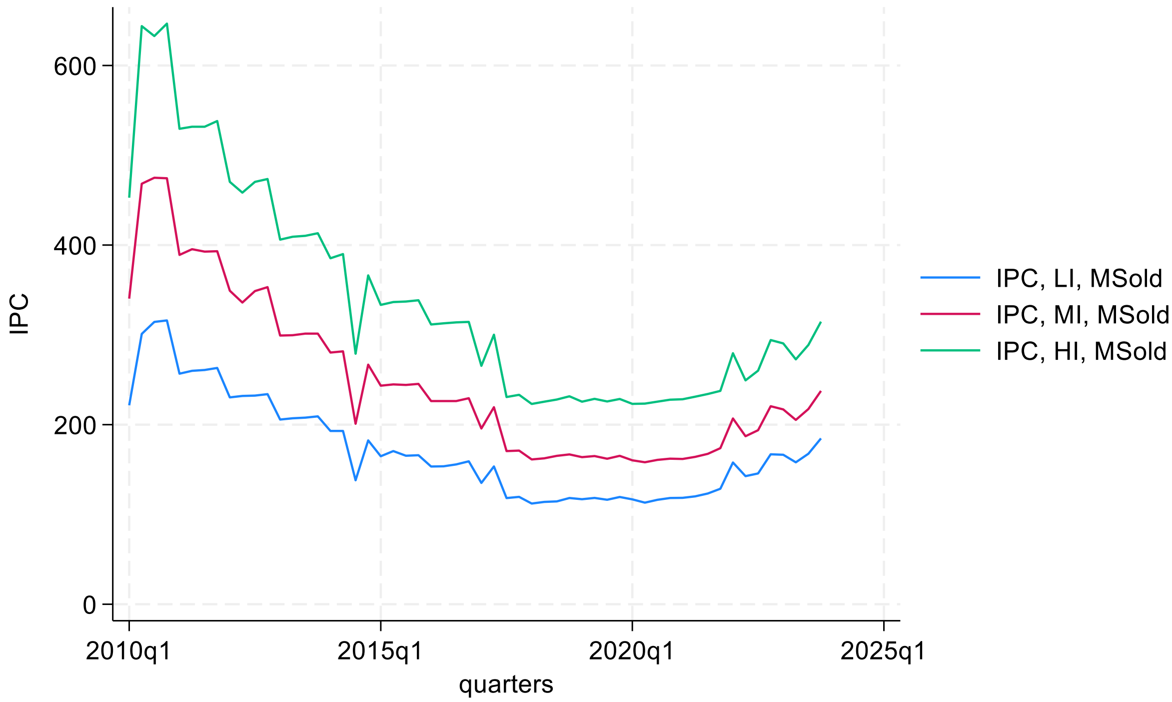
Figure 7. MoL for the cheapest and most-sold price category



Source: Authors' calculations

We conclude the trend analysis of affordability measures with the IPC. The IPC serves as a reflection of the RIP measure. In Figure 8, we present the IPC by the three income groups. As previously mentioned, the IPC is a mirror reflection of the RIP, showing that cigarette affordability was declining until Q4 2019, after which it sharply increased. Cigarettes were most affordable for the high-income group (Figure 8).

Figure 8. IPC, based on ANW, by income groups



Source: Authors' calculations

In Figure 9, we present the IPC calculated by using both proxies for income, ANW and DI. Essentially, the same trends show a decrease in affordability and a sharp increase after Q1 of 2020.

Figure 9. IPC, based on ANW and DI

Source: Authors' calculations

Models 1 and 2 regression results

Our analysis covers the period from 2010 to 2023 and is based on quarterly data. To estimate Model 1, we use the most-sold price category. The most-sold cigarette price category accounts for 25.91 percent of total legal quantity sales. The first step is to test our data for stationarity. To do so, we applied the augmented Dickey-Fuller (ADF) test and the Zivot-Andrews (ZA) unit root test, accounting for the presence of a structural break. The results of the unit root tests are presented in the Appendix (Table A1).

The ADF test suggests that all series are integrated of order 1. Since all our series are stationary, we proceed with the error-correction model (ECM) for both Model 1 and Model 2. The first step is to test for cointegration in Model 1 by applying the Johansen procedure. Since Model 1 refers to estimation price and income elasticity, while Model 2 refers to the estimation affordability elasticity, different variations of the model—depending on variables included—are denoted by adding a dot in the numbering (for example, Model 1.1). The results of the Johansen test are presented in the Appendix (Table A2).

The Johansen test indicates that our data are cointegrated, so we proceed with the two-step Engle-Granger procedure. In the first step, we estimate the long-run equilibrium, and in the second step, we estimate the short-run equilibrium. The results are presented in Table 3.

Table 3. Estimation results, Model 1

	Model 1.1	**Model 1.2**	**Model 1.3**
Long-run estimations			
Most-sold price category *(real, log)*	-0.889***	-0.885***	-0.970***
	[-11.709]	[-11.344]	[-7.795]
Real disposable income *(in logs)*	0.554***	0.587***	0.522**
	[2.679]	[2.805]	[2.533]
Law on Tobacco (2010)		-0.248***	-0.254***
		[-8.138]	[-7.693]
Code on Commercial Communications (2016)			0.088
			[0.967]
Constant	-0.020	-0.036	0.539
	[-0.013]	[-0.023]	[0.353]
Observations	56	56	56
R-squared	0.794	0.805	0.809
Log Lik	30.12	31.64	32.26
AIC	-54.24	-57.27	-56.51
BIC	-48.16	-51.19	-48.41
Adj. R-squared	0.786	0.794	0.794
Short-run estimations			
Most-sold price *(first logarithmic difference)*	-0.532***	-0.444**	-0.493**
	[-2.910]	[-2.184]	[-2.217]

Real disposable income *(first logarithmic difference)*	1.122***	1.083***	1.038***
	[4.162]	[3.858]	[3.595]
Law on tobacco (2010) *(first logarithmic difference)*		-0.082	-0.097
		[-1.100]	[-1.204]
Code on commercial communications (2016) *(first logarithmic difference)*			-0.014
			[-0.367]
Resid, *lagged*	-0.870***	-0.886***	-0.932***
	[-6.806]	[-6.807]	[-6.903]
Constant	-0.012	-0.011	-0.009
	[-0.691]	[-0.617]	[-0.528]
Observations	55	55	55
R-squared	0.542	0.548	0.573
Log Lik	34.85	35.26	36.79
AIC	-61.69	-62.51	-65.58
BIC	-53.66	-54.48	-57.55
Adj. R-squared	0.515	0.512	0.529

Source: Authors' calculations

The results of the estimated models show that all variables are statistically significant and have the expected signs except for variables related to the adoption of the Code on Commercial Communication (2016). The price of cigarettes, income, and adoption of the Law on Tobacco (2010) are statistically significant in the long run. Since the quantity of cigarettes consumed, price of cigarettes, and income are expressed in logarithms, they are interpreted as elasticity coefficients.

Based on the information criteria from Table 3, we conclude that the second estimation of Model 1 (Model 1.2.) is the most efficient estimator. According to the results from Model 1.2, a 10-percent increase in cigarette prices will decrease demand for cigarettes by 8.85 percent in the long run. Short-run price elasticity is lower in absolute terms, as expected, and suggests that a 10-percent price increase will decrease demand for cigarettes by 4.44 percent. Income elasticities in the long run and short run are estimated at 0.587 and 1.083, respectively, indicating that an increase in income would make cigarettes more affordable and increase consumption. Therefore, the introduction of the Law on Tobacco (2010) would have a positive impact on consumption decrease in the long run.

The coefficient of the lagged residuals represents the error-correction term (ECM), which measures the speed of adjustment toward equilibrium—that is, the speed at which a variable returns to equilibrium after a short-term deviation. The coefficient is statistically significant, and another one proves the existence of cointegration. It takes a value of -0.886 (Model 1.2), which implies that the system corrects itself and moves back toward equilibrium. About 87 percent of the deviation from an equilibrium is corrected within the period observed (quarter), while about 13 percent of the deviation is corrected in the next period. In practical terms, this means that cigarette demand, due to its addictive nature, does not respond instantly to short-term changes. Instead, it takes roughly one quarter for the system to correct most of the deviation, with the full adjustment likely requiring several more months. This gradual response reflects the inherent inertia in consumer behavior for addictive goods.

After estimating the long- and short-run coefficients of Model 1, in which we estimate income and price elasticity, we proceed with the analysis by estimating the affordability elasticity from Model 2. The results of the unit root and cointegration tests, which suggest that our variables are cointegrated of order 1, are in the Appendix (tables A1, A4, and A7). A summary of the Model 2 estimations, highlighting the most efficient results, is presented in Table 4. Detailed estimations can also be found in the Appendix (tables A5 and A8).

According to the information criteria for the long-run model, Model 2.2 is the most efficient estimator (Table 4). Our variable of interest, RIP, is statistically significant and positive, as expected. The estimated affordability elasticity is 0.85, implying that a decrease in affordability of 10 percent is associated with a decrease in consumption by approximately 8.5 percent. Dummy variables that denote the introduction of the Law on Tobacco (2010) are also statistically significant and negative in the long run. This suggests that tobacco control measures decrease cigarette consumption, but in the short run this effect is not significant. On the other hand, introduction the Code on Commercial Communications (2016) which banned advertising tobacco decreases consumption in the short run. The short-run equation also suggests the significance of the affordability variable, as well as the error-correction term. ECM is statistically significant, negative, and takes a value of -0.85, suggesting that a disequilibrium is corrected quickly.

According to the information criteria, Model 2.5. is the most efficient estimator. Similar to the results when RIP is calculated based on ANW, this variable is statistically significant for explaining cigarette consumption in both the short and long run. The implementation of the Law on Tobacco (2010) contributed to a decrease in tobacco consumption, while the statistical significance of ECM and its value close to zero (0.890) means a fast adjustment back to equilibrium. A 10-percent increase in affordability increases consumption by 9.67 percent in the long run and 6.69 percent in the short run.

Table 4. Estimation results, most efficient estimations of Model 2

	Model 2.2 (Based on ANW)	**Model 2.5 (Based on DI)**
Long-run estimations		
Relative income price *(calculated based on average net wage, in logs), two lags*	-0.847***	-0.967***

	[-13.942]	[-15.290]
Law on Tobacco (2010), *two lags*	-0.222***	-0.271***
	[-8.150]	[-11.468]
Code on Commercial Communications (2016), *two lags*		
Constant	2.667***	1.588***
	[38.145]	[11.819]
Observations	54	54
R-squared	0.780	0.810
Log Lik	26.50	30.43
AIC	-48.99	-56.85
BIC	-45.02	-52.88
Adj. R-squared	0.772	0.803
Short-run estimations		
Relative income price *(calculated based on average net wage, first logarithmic difference), two lags*	-0.428*	-0.669***
	[-1.811]	[-3.004]
Law on Tobacco (2010) (*first difference*), *two lags*	-0.021	-0.136
	[-0.259]	[-1.591]
Code on Commercial Communications (2016) *(first difference), two lags*		
Residual, *lagged*	-0.849***	-0.898***
	[-6.670]	[-7.242]
Constant	-0.007	-0.004
	[-0.341]	[-0.198]
Observations	53	53
R-squared	0.446	0.506

Log Lik	27.78	30.82
AIC	-49.56	-55.64
BIC	-43.65	-49.73
Adj. R-squared	0.412	0.476

Source: Authors' calculations

Impact of tax increases on cigarette affordability

To run a simulation exercise to evaluate and forecast the effectiveness of tobacco control policies through tax and price increases, we use the long-run estimations of price and income elasticities from Model 1.2 (the best model based on the information criteria). Additionally, we use the long-run estimation of the RIP (calculated based on the most-sold price category and disposable income) from Model 2.5 (the best model based on the information criteria and adjuster R square). The results of the simulations are presented in Table 5.

Table 5. Simulations

Price elasticity	-0.885
Income elasticity	0.587
Affordability elasticity	-0.967
Desired change in cigarette consumption	-10%
Disposable income average growth rate	1.37%
Required change in price using price and income elasticities	12.21%
Required change in RIP using affordability elasticity	10.34%
Required change in price using affordability elasticity	11.71%
Initial tax rate (specific excise as % of price)	28%
Required specific excise tax increase (per unit of cigarette consumption)	

Using both price and income elasticities	43.61%
Using affordability elasticity	36.93%
Consumption effect of a tax change informed by affordability elasticity	
Using price and income elasticities	-9.56%
Using affordability elasticity	-10.00%
Revenue effect of a tax change informed by affordability elasticity	
Using price and income elasticities	34.05%
Using affordability elasticity	26.93%

Source: Authors' calculations

The specific excise accounts for 28 percent of cigarette price. Based on our simulations, to reduce consumption by 10 percent, policy makers should increase the specific excise by 37–44 percent, which would raise tax revenue from the specific excise by 27–34 percent. Given that there has been no increase in the specific excise tax from 2019 to 2024, aiming for a substantial adjustment—such as a 50-percent increase—would be a more effective approach than a lower incremental increase, even if full implementation presents challenges. The current specific excise tax is 1.65 BAM per pack of cigarettes. A 50-percent increase would raise the specific excise tax to 2.475 BAM per pack. In 2023, the total excise revenue (specific excise and ad valorem) amounted to 968,700,717 BAM, with specific excise contributing 39.5 percent, equivalent to 382,896,127 BAM. A proposed 50-percent increase in the specific excise tax would boost revenues by 40.4 percent, resulting in 537,586,162 BAM in specific excise revenue.

Discussion

Our first model, based on prices (most-sold price category) and real disposable income, yielded the following results: a 10-percent price increase would reduce cigarette consumption by 8.85 percent, while a 10-percent increase in real disposable income would increase consumption by 5.87 percent. These findings are consistent with other authors who obtained price elasticity coefficients ranging from -0.212 (Nargis et al., 2021) in LMICs to -0.65 in Southeastern Europe (Zubović et al., 2024). As for the income (in some cases GDP per capita) changes, other authors come to a similar and expected result, showing that an increase in income raises cigarette affordability and consumption (Appau et al., 2017a; Krasovsky, 2012; Nargis et al., 2019). This effect is more pronounced in LMICs (Appau et al., 2017a), where Nargis et al. (2021) estimated income elasticity of demand to be 0.319, albeit using GDP per capita as a variable, while Zubović et al. (2024) estimated the coefficient to be around 0.45 in Southeastern Europe. What is unique about our model is that we use real disposable income as a measure of income.

The Law on Tobacco (2010) in BiH also proves to be highly statistically significant in our analysis (with a β of -0.248, and *p* value at 0.000). Krasovsky (2012), suggests that tobacco control policies apart from taxation introduced in Baltic countries following their EU accession helped reduce cigarette consumption due to a culture change.

When considering changes in cigarette consumption against the RIP as a variable, our model suggests an elasticity coefficient of -0.967, meaning that a 10-percent increase in the RIP (that is, an equivalent decrease in cigarette affordability) would decrease cigarette consumption by 9.67 percent in BiH. The direction of this finding is also supported by other authors although there is a difference in its intensity. While others report coefficients ranging between -0.2 and -0.6 (Blecher & Van Walbeek, 2004; Zheng et al., 2017; Nargis et al., 2021), with Zubović et al. (2023) concludes that it ranges between -0.6 and 0.7 Our analysis for BiH using the RIP shows that tobacco smokers in the country are even more sensitive to changes in affordability.

The reason for the slightly higher sensitivity of smokers in BiH to changes in affordability could be the fact that the budget share spent on cigarettes in BiH is higher relative to other observed countries (Hu & Mao, 2006; Gligoric et al., 2018; Mugoša et al., 2018; Gjika et al., 2020; Aljinović Barać et al., 2018). If a certain product accounts for a large share of the consumer budget, changes in affordability will have a stronger impact on consumption than if products make up a smaller portion of the budget.

This model shows an important role of the Law on Tobacco (2010) as well, yielding a highly significant coefficient of -0.271 (*p* value at 0.000). As with the first model, there is no consistent conclusion about the role of such policies with other authors, as some point out their significance (Blecher & Van Walbeek, 2004; Krasovsky, 2012; Nargis et al., 2021).

We also run a tax simulation based on our previous models. Starting from the initial conditions in BiH, where specific excise taxes account for 28 percent of the most-sold price category and the weighted average retail sales price, our analysis indicates that to achieve a 10-percent reduction in cigarette consumption a tax increase of 43.61 percent would be required according to Model 1 (which incorporates both price and income elasticities) and 36.93 percent based on the model utilizing RIP. Respectively, a 34.05-percent and 26.93-percent increase in tax revenue would occur if this happened. A comparable analysis can be found with Nargis et al. (2021) who start with a tax rate amounting to 50 percent of the price, concluding that a 101-percent tax increase per unit of cigarette consumption is needed, and it would increase revenue by 91 percent.

Limitations

The major limitation of this study is the lack of data. The HBS data for Bosnia and Herzegovina are available for only four years—2007, 2011, 2015, and 2022—making analysis based on microdata unfeasible. Consequently, the analysis was conducted using macro data. Our time series covers the period from 2010 to

2023, which is insufficient for econometric analysis based on annual data. Therefore, we used quarterly macro data.

Conclusions

All indicators used in this analysis to examine the trends in affordability confirmed a decreasing trend until 2020 and then a reverse in the trend. Abandoning the growth of excise taxes after 2019, in conjunction with the growth of CPI and GDP, made cigarettes in BiH more affordable. Increasing affordability of cigarettes inevitably leads to an increase in tobacco prevalence and consumption, which will make the problem of the continued smoking pandemic in BiH more pronounced.

Results show that the price elasticity of demand for cigarettes in BiH is less than one, with a negative impact on consumption, meaning that a 10-percent increase in price would decrease cigarette consumption by 8.85 percent. Income elasticity of demand is below one, indicating that cigarettes in BiH are normal goods, as a 10-percent increase in income would lead to a 5.87-percent increase in cigarette consumption, highlighting the positive impact of income growth on demand for tobacco products. Affordability elasticity has a negative impact on cigarette consumption in BiH, and elasticity is almost equal to one, meaning that with a 10-percent increase in the RIP (that is, an equivalent decrease in cigarette affordability) cigarette consumption would decrease by 9.67 percent.

Tobacco control variables, such as stricter laws on tobacco control (Law on tobacco (2010)) and a ban on tobacco advertising (Code on Commercial Communications (2016)) were also found to be a statistically significant and yield the expected effect: reduction in cigarette consumption.

The simulation of the impact of increased cigarette specific excise growth, based on the estimated elasticities, shows that a significant increase in the specific excise is needed (between 37 and 44 percent) for a 10-percent decrease in cigarette consumption, which indicates the need for a significant increase in the excise tax. Although the simulation analyzes a 37- to 44-percent increase in specific excise, we believe that aiming for a 50-percent adjustment would be a more effective approach. While this represents a significant increase, it is justified given that there has been no adjustment in the past five years. Furthermore, such a measure would not only positively influence consumption patterns but also generate higher budget revenues, which is particularly important in the current economic context to support fiscal stability.

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Appendix

Table A1. Unit root tests

ADF test				
Variable	**Test statistics**	**Dickey-Fuller critical value**		
		1%	**5%**	**10%**
Cigarette consumption per capita (in log) – lq	-1.998	-3.574	-2.927	-2.598
Cigarette consumption per capita (first logarithmic difference) - dlq	-7.296	-3.576	-2.928	-2.599
Real disposable income (in logs) – lrdi	-2.215	-4.146	-3.498	-3.179
Real disposable income (first logarithmic difference) - dlrdi	-9.377	-4.146	-3.498	-3.179
Relative income price, based on the ANW (in logs) - lrip	-1.810	-2.618	-1.950	-1.610
Relative income price, based on the ANW (first logarithmic difference) – dlrip	-6.266	-2.619	-1.950	-1.610
Most-sold price category (real, in logs) - lm_soldr	-1.785	-3.574	-2.927	-2.598
Most-sold price category (first logarithmic difference) - dlm_soldr	-6.651	-3.576	-2.928	-2.599
Relative income price, based on the disposable income (in logs) – lripdi	-1.891	-3.574	-2.927	-2.598
Relative income price, based on the disposable income (first logarithmic difference) - dlripdi	-7.998	-4.143	-3.497	-3.178
ZA test				
Variable	**Test statistics**	**Zivot-Andrews critical value**		
		1%	**5%**	**10%**
Cigarette consumption per capita (in log) - lq	-4.223	-5.57	-5.08	-4.82
Cigarette consumption per capita (first logarithmic difference) - dlq	-14.154	-5.57	-5.08	-4.82

Real disposable income (in logs) - lrdi	-4.709	-5.57	-5.08	-4.82
Real disposable income (first logarithmic difference) - dlrdi	-10.072	-5.57	-5.08	-4.82
Relative income price, based on the ANW (in logs) - lrip	-4.731	-5.57	-5.08	-4.82
Relative income price, based on the ANW (first logarithmic difference) – dlrip	-12.857	-5.57	-5.08	-4.82
Most-sold price category (real, in logs) - lm_soldr	-5.033	-5.57	-5.08	-4.82
Most-sold price category (first logarithmic difference) - dlm_soldr	-12.703	-5.57	-5.08	-4.82
Relative income price, based on the disposable income (in logs) – lripdi	-4.646	-5.57	-5.08	-4.82
Relative income price, based on the disposable income (first logarithmic difference) - dlripdi	-9.537	-5.57	-5.08	-4.82

Source: Authors' calculations

Table A2. Johansen cointegration test, Model 1

Null hypothesis	Eigen value	Trace statistics	0.05 critical value
Model 1.1 - Vecrank: lq lm_soldr lrdi, trend(n)			
H0: (R=0)	.	25.01	24.31
H0: (R≤1)	0.24479	9.8487*	12.53
H0: (R≤2)	0.14641	1.3003	3.84
H0: (R≤3)	0.02379		
Model 1.2 - Vecrank: lq lm_soldr lrdi tob_low, trend(n)			
H0: (R≤0)	.	324.5643	39.89
H0: (R≤1)	0.99396	43.5704	24.31
H0: (R≤2)	0.48551	7.0184*	12.53
H0: (R≤3)	0.10415	0.9692	3.84
H0: (R≤4)	0.01747		
Model 1.3 - Vecrank: lq lm_soldr lrdi tob_low adv_ban, trend(n)			
H0: (R=0)	.	344.5772	59.46
H0: (R≤1)	0.99473	56.0133	39.89
H0: (R≤2)	0.52796	14.7256*	24.31
H0: (R≤3)	0.14293	6.243	12.53
H0: (R≤4)	0.09039	1.0325	3.84

H0: (R≤5)	0.0186		

Source: Authors' calculations

Table A3. Post-estimation, Model 1

	Model 1.1	Model 1.2	Model 1.3
Heteroskedasticity Breush-Pagan/Cook-Weisberg test			
chi2(1)	0.33	0.43	1.15
Prob > chi2	0.5673	0.5115	0.2846
Durbin's alternative test for autocorrelation			
lags(p)	1	1	1
chi2	2.177	1.829	1.737
Df	1	1	1
Prob > chi2	0.1401	0.1763	0.1875
Breusch–Godfrey LM test for autocorrelation			
lags(p)	1	1	1
chi2	2.294	1.979	1.921
df	1	1	1
Prob > chi2	0.1298	0.1595	0.1657
Ramsey RESET test for omitted variables			
F (3, 48) = 1.34	1.34	1.26	1.01
Prob > F	0.2714	0.3005	0.3987
Skewness and kurtosis tests for residual normality			
Obs	55	55	55
Pr(skewness)	0.0402	0.0491	0.0762
Pr(kurtosis)	0.3548	0.4995	0.7784
Adj chi2(2)	4.99	4.41	3.4
Prob>chi2	0.0827	0.1101	0.183
Jarque-Bera normality test for residual			
Test statistics	4.173	3.624	2.839
Chi (2)	0.1241	0.1633	0.2418
Mean VIF	1.04	1.17	1.17

Source: Authors' calculations

Table A4. Johansen cointegration test, RIP – based on ANW, Model 2

Null hypothesis	Eigen value	Trace statistics	0.05 critical value

Model 2.1 - Vecrank: lq lrip_ms, trend(n)			
H0: (R=0)	.	7.1503*	12.53
H0: (R≤1)	0.11636	0.4705	3.84
H0: (R≤2)	0.00867		
Model 2.2 - Vecrank: lq lrip_ms tob_low, trend(n)			
H0: (R=0)	.	146.555	24.31
H0: (R≤1)	0.92107	6.9008*	12.53
H0: (R≤2)	0.11183	0.3781	3.84
H0: (R≤3)	0.00685		
Model 2.3 - Vecrank: lq lrip_ms tob_low, adv_ban, trend(n)			
H0: (R=0)	.	158.0549	39.89
H0: (R≤1)	0.92422	16.1581*	24.31
H0: (R≤2)	0.18289	5.0492	12.53
H0: (R≤3)	0.08769	0.0016	3.84
H0: (R≤4)	0.00003		

Source: Authors' calculations

Table A5. Estimation results, RIP, Msold based on ANW, Model 2

	Model 2.1	Model 2.3
Long-run estimations		
Relative income price *(calculated based on average net wage, in logs), two lags*	-0.860***	-0.931***
	[-14.461]	[-7.137]
Law on Tobacco (2010), *two lags*		-0.231***
		[-7.271]
Code on Commercial Communications (2016), *two lags*		0.064
		[0.706]
Constant	2.439***	2.572***
	[43.818]	[17.141]
Observations	54	54
R-squared	0.772	0.783
Log Lik	25.44	26.86
AIC	-46.88	-47.71
BIC	-42.90	-41.75

Adj. R-squared	0.767	0.770
Short-run estimations		
Relative income price *(calculated based on average net wage, first logarithmic difference), two lags*	-0.530**	-0.454*
	[-2.427]	[-1.787]
Law on Tobacco (2010) (*first difference*), *two lags*		-0.032
		[-0.362]
Code on Commercial Communications (2016) *(first difference), two lags*		-0.077**
		[-2.436]
Residual, *lagged*	-0.835***	-0.885***
	[-6.663]	[-6.860]
Constant	-0.006	-0.005
	[-0.322]	[-0.237]
Observations	53	53
R-squared	0.435	0.468
Log Lik	27.27	28.84
AIC	-48.54	-51.68
BIC	-42.63	-45.77
Adj. R-squared	0.413	0.423

Source: Authors' calculations

Table A6. Post-estimation, RIP based on ANW, Model 2

	Model 2.1	Model 2.2	Model 2.3
Durbin's alternative test for autocorrelation			
lags(p)	1	1	1
chi2	3.764	3.817	3.215
Df	1	1	1
Prob > chi2	0.0524	0.0507	0.073
Ramsey RESET test for omitted variables			
F	0.77	0.89	0.59
Prob > F	0.5172	0.453	0.626
Skewness and kurtosis tests for residual normality			
Obs	53	53	53

Pr(skewness)	0.0879	0.0884	0.0906
Pr(kurtosis)	0.4416	0.357	0.3485
Adj chi2(2)	3.7	3.95	3.95
Prob>chi2	0.157	0.1385	0.139
Jarque-Bera normality test for residual			
Test statistics	3.262	3.391	3.368
Chi (2)	0.1957	0.1835	0.1856
Mean VIF	1.05	1.19	1.16

Source: Authors' calculations

Table A7. Johansen cointegration test, RIP - MSold and DI, Model 2

Null hypothesis	**Eigen value**	**Trace statistics**	**0.05 critical value**
Model 2.4 - Vecrank: lq lripdi_ms, trend(n)			
H0: (R=0)	.	6.963*	12.53
H0: (R≤1)	0.0956	1.532	3.84
H0: (R≤2)	0.0279		
Model 2.5 - Vecrank: lq lripdi_ms tob_low, trend(n)			
H0: (R=0)	.	118.2422	24.31
H0: (R≤1)	0.85374	12.5116*	12.53
H0: (R≤2)	0.19545	0.5504	3.84
H0: (R≤3)	0.00996		
Model 2.6 - Vecrank: lq lripdi_ms tob_low adv_ban, trend(n)			
H0: (R=0)	.	143.9247	3.89
H0: (R≤1)	0.88845	23.2941*	24.31
H0: (R≤2)	0.28999	4.4581	12.53
H0: (R≤3)	0.07707	0.0467	3.84
H0: (R≤4)	0.00085		

Source: Authors' calculations

Table A8. Estimations results, RIP based on DI, Model 2

	Model 2.4	**Model 2.6**
Long-run estimations		
Relative income price *(calculated based on the disposable income, in logs), two lags*	-0.981***	-1.012***

	[-15.688]	[-7.748]
Law on Tobacco (2010), *two lags*		-0.279***
		[-8.310]
Code on Commercial Communications (2016) *two lags*		0.033
		[0.402]
Constant	1.295***	1.491***
	[10.704]	[5.369]
Observations	54	54
R-squared	0.797	0.811
Log Lik	28.61	30.55
AIC	-53.22	-55.11
BIC	-49.24	-49.14
Adj. R-squared	0.793	0.800
Short-run estimation		
Relative income price *(calculated based on disposable income, first logarithmic difference), two lags*	-0.731***	-0.674***
	[-3.828]	[-2.874]
Law on Tobacco (2010) *(first difference), two lags*		-0.139
		[-1.556]
Code on Commercial Communications (2016) *(first difference), two lags*		-0.031
		[-0.729]
Residual, *lagged*	**-0.883*** **	**-0.914*** **
	[-7.269]	[-7.331]
Constant	-0.006	-0.003
	[-0.319]	[-0.147]
Observations	53	53
R-squared	0.502	0.514
Log Lik	30.60	31.25
AIC	-55.20	-56.49
BIC	-49.29	-50.58
Adj. R-squared	0.482	0.473

Source: Authors' calculations

Table A9. Post-estimation, RIP based on DI, Model 2

	Model 2.4	Model 2.5	Model 2.6
Durbin's alternative test for autocorrelation			
lags(p)	1	1	1
chi2	2.677	2.734	2.247
Df	1	1	1
Prob > chi2	0.1018	0.1452	0.1338
Ramsey RESET test for omitted variables			
F	0.22	0.032	0.31
Prob > F	0.874	0.8119	0.817
Skewness and kurtosis tests for residual normality			
Obs	53	53	53
Pr(skewness)	0.1543	0.1597	0.164
Pr(kurtosis)	0.3571	0.4893	0.459
Adj chi2(2)	3.04	2.58	2.61
Prob>chi2	0.2193	0.2746	0.271
Jarque-Bera residual normality test			
Test statistics	2.008	1.776	1.764
Chi (2)	0.3664	0.4115	0.4139
Mean VIF	1.05	1.20	1.18

Source: Authors' calculations