

# Elasticity of tobacco products in Bosnia and Herzegovina – macro data analysis

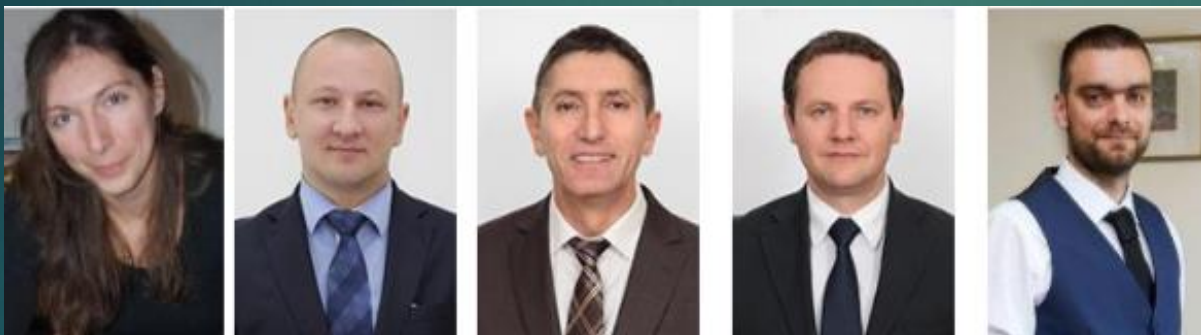
RESEARCH PROJECT: ACCELERATING PROGRESS ON TOBACCO TAXES  
IN LOW-AND MIDDLE INCOME COUNTRIES

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# RESEARCH TEAM

## ▶ INSTITUTION:

- University of Banja Luka
- Entrepreneurship and Technology Transfer Centre
- Center for Project Management and Entrepreneurship, Faculty of Economics



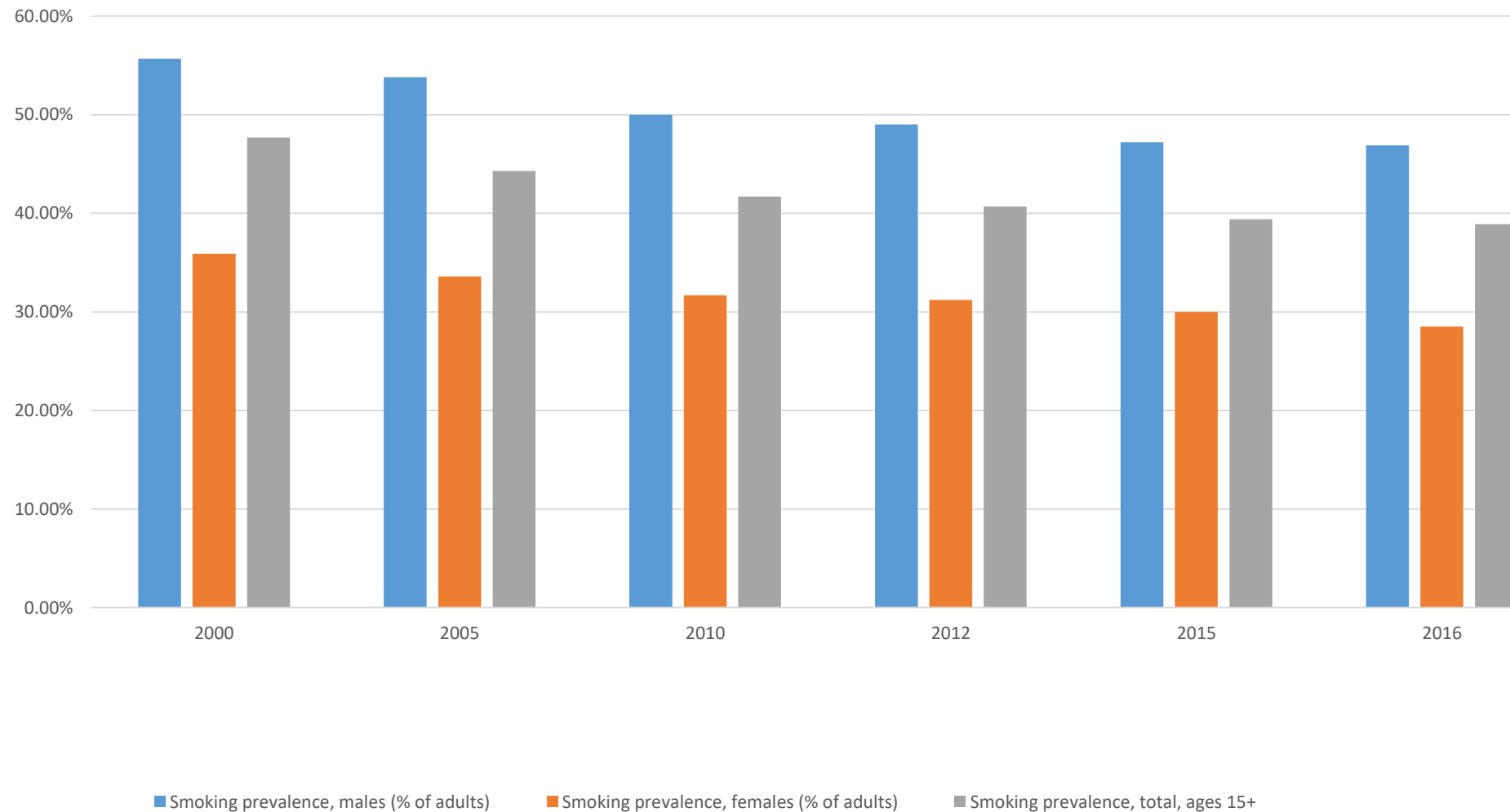
## TOBACCO TAXATION RESEARCH TEAM:

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# Tobacco use trends in Bosnia and Herzegovina

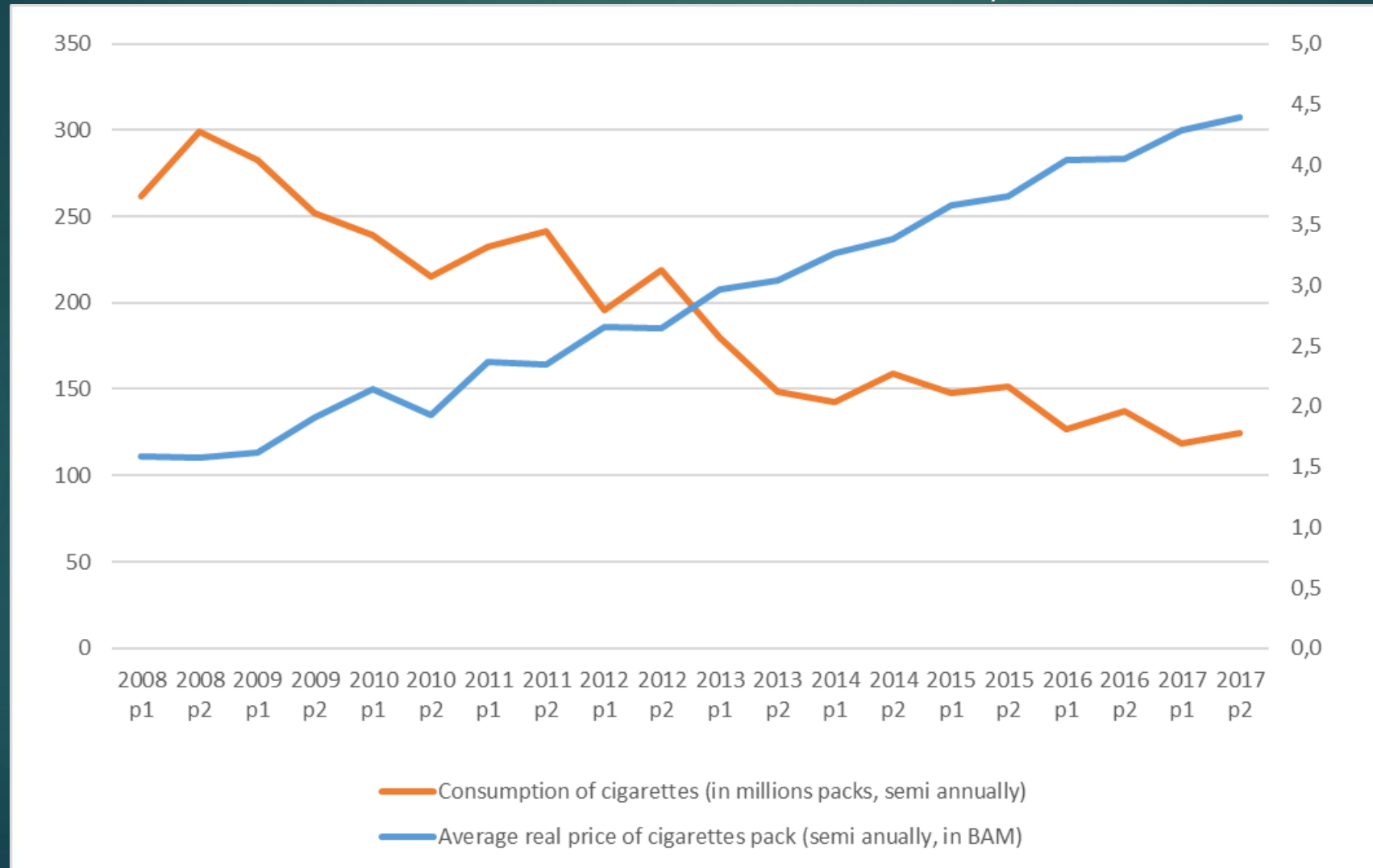
- ▶ BiH is among the top 10 countries in the world according to the level of smoking prevalence (World Atlas, 2018).
- ▶ Smoking prevalence in BiH is 38% with a significant difference between men (46.9%) and women (28.5%)
- ▶ Among youth, tobacco use prevalence among girls (9.7%) is significantly lower than among boys (15.5%).
- ▶ The HBS data for 2011 and 2015 shows that in approximately 41% of the households had an individual that smoked cigarettes.

# Prevalence of tobacco consumption in Bosnia and Herzegovina, 2000 to 2016 (Source: The World Bank, 2018)



# Movement of prices and consumption of cigarettes in Bosnia and Herzegovina - semi-annual data (2008-2017)

(Source: Author calculations based on data from ITA, 2018)



# Consumption of cigarettes (*semi annually*) per capita (adult)

Consumption was above 3.300 cigarettes per year



Consumption is above 1.600 cigarettes per year

# Tobacco tax burden in B&H

- ▶ Until second half of 2009 we had only ad valorem excise amounted to 42% of retail price
- ▶ In second half of 2009 B&H introduced specific excise (3.83 EUR per 1000 sticks)
- ▶ Every year, specific excise was increasing by 3,83 EUR per 1000 sticks
- ▶ In 2019 excises of cigarettes consists of:
  - ▶ specific excise is amounted to 42 EUR per 1000 sticks,
  - ▶ Ad valorem excise, 42 % of retail prices
- ▶ Excise on cut tobacco is 58.5 EUR/kg

# Tabacco tax (and Tax+VAT) burden in the period 2010-2018

	Year								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Weighted Average Price (pack of 20) (in EUR)</b>	<b>0.89</b>	<b>1.06</b>	<b>1.27</b>	<b>1.45</b>	<b>1.64</b>	<b>1.80</b>	<b>1.98</b>	<b>2.15</b>	<b>2.33</b>
VAT (14,52% of price)	0.13	0.15	0.18	0.21	0.24	0.26	0.29	0.31	0.34
Ad valorem excise (42% of price)	0.37	0.44	0.53	0.61	0.69	0.75	0.83	0.90	0.98
Specific excise (value)	0.15	0.23	0.31	0.38	0.46	0.54	0.61	0.69	0.77
Total Excise Burden per pack (in EUR)	0.52	0.67	0.84	0.99	1.15	1.29	1.44	1.59	<b>1.74</b>
<b>Total Excise Burden per pack (as % of price)</b>	<b>58.85%</b>	<b>63.80%</b>	<b>66.41%</b>	<b>68.21%</b>	<b>70.05%</b>	<b>72.08%</b>	<b>72.89%</b>	<b>74.17%</b>	<b>74.99%</b>
Total Excise and VAT Burden per pack (in EUR)	0.65	0.83	1.03	1.20	1.39	1.55	1.73	1.90	<b>2.08</b>
<b>Total Excise and VAT Burden (as % of price)</b>	<b>73.38%</b>	<b>78.33%</b>	<b>80.94%</b>	<b>82.74%</b>	<b>84.58%</b>	<b>86.61%</b>	<b>87.42%</b>	<b>88.70%</b>	<b>89.52%</b>



# Tobacco budget revenue

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total consumption of tobacco products (EUR in million)	453.74	473.96	557.73	600.71	608.08	572.62	567.7	591.77	566.59	565.91
Calculated VAT on tobacco products (EUR - in million)	65.92	68.86	81.03	87.28	88.35	83.2	82.48	85.98	82.32	82.22
Fixed + ad valorem excise (EUR - in million)	190.02	414.4	312.75	361.24	383.49	367.41	377.26	409.06	400	405.46
<b>Total budget revenue from tobacco</b>	<b>255.94</b>	<b>483.26</b>	<b>393.78</b>	<b>448.52</b>	<b>471.84</b>	<b>450.61</b>	<b>459.74</b>	<b>495.04</b>	<b>482.32</b>	<b>487.68</b>

# Elasticity of demand for cigarettes

## *Data and methods*

- ▶ In order to estimate elasticity of demand cigarettes in BiH we develop the econometrics model of cigarettes demand which is:
  - ▶ based on semi-annual data at macro level
  - ▶ developed for the period 2008-2017
- ▶ The data related to cigarettes consumption and prices in BiH are available for the very short period (2008-2017)
- ▶ To have sufficient data for implementing time-series analysis, we use semi-annual data fom 2008p1 to 2017p2

# Data and Methods

- ▶ We estimated the following model
  - ▶  $\text{cons}_t = \alpha + \beta_0 \text{rtcpi}_t + \beta_1 \text{rincom}_t + \beta_2 \text{tcontrol}_t + \varepsilon_t$ , where
    - ▶  $\text{cons}_t$  - consumption of cigarettes per capita (per adult)
    - ▶  $\text{rtcpi}_t$  - real tobacco CPI index
    - ▶  $\text{rincom}_t$  – Real income, (proxied by three different indicators – real GDP pc, real disposable income and real wages)
    - ▶  $\text{tcontrol}_t$  – we use three different indicators related to the tobacco control environment
      - ▶  $\text{flaw}$  – dummy variable which represent **introduction of Law on tobacco** in 2010
      - ▶  $\text{aban}$  – dummy variable which represent the **adoption of Commercial code of Communication** in December in 2015
      - ▶  $\text{tcindex}$  – sum of two dichotomus indicators  $\text{flaw}$  and  $\text{aban}$
  - ▶ Inability of official population statistic in BiH prevented from using other control variables such as m/f ratio, education...

## Data and Methods

- ▶ We use all variables in **logarithm**, except, of course tobacco control variables which is dummy variables
- ▶ We detect that three variables, *lrtcpi*, *lrincome* and *lrdincome* have **seasonality**, therefore, we use Tramo/Seats statistical tools to eliminate seasonality from this variables.
- ▶ Dickey-Fuller **unit root test** indicates that only real income and real disposable income have unit roots in levels, but not in the first differences
- ▶ According to the results of unit root test, we can use the following econometric methods:
  - ▶ OLS, but if variables is  $I(0)$ , such is Real GDP pc and Real GNI pc, we use them in first differences - this is correct because *dlncom* and *dldrcom* are real growth rates
  - ▶ We can use ARDL (risk for reliability of results is very short time series)
  - ▶ We opt for OLS and for use ARDL as the second robustness check

# Results (with real GDP as a proxy for income)

VARIABLES	(1)	(2)	(3)	(4)
	lcons	lcons	lcons	lcons
lrtcpi	-0.827***	-0.778***	-0.839***	-0.790***
	[0.077]	[0.133]	[0.101]	[0.097]
dlrincome	0.250	0.342	0.189	0.215
	[1.404]	[1.454]	[1.479]	[1.431]
tcindex		-0.029		
		[0.064]		
tlaw			0.015	
			[0.076]	
aban				-0.043
				[0.066]
Constant	11.355***	11.131***	11.408***	11.173***
	[0.392]	[0.635]	[0.482]	[0.487]
Observations	19	19	19	19
R-squared	0.913	0.914	0.913	0.916
F statistic (prob.)	0.000	0.000	0.000	0.000
D-W d-statistic	2.061	1.928	2.120	2.002
Breusch-Pagan / Cook-Weis. test for heter. (Prob > chi2)	0.809	0.832	0.763	0.769
JB test (Prob.)	0.890	0.921	0.876	0.916
Ramsey RESET test (Prob.)	0.763	0.721	0.741	0.823
Multicollinearity test (vif)	1.50	3.28	2.06	1.83

# Results (with real disposable as a proxy for income)

VARIABLES	(1) lcons	(2) lcons	(3) lcons	(4) lcons
lrtcpi	-0.776*** [0.094]	-0.756*** [0.133]	-0.799*** [0.103]	-0.736*** [0.112]
dlrdincome	-1.200 [2.001]	-1.010 [2.223]	-1.908 [2.350]	-1.279 [2.037]
tcindex		-0.016 [0.068]		
tlaw			0.051 [0.083]	
aban				-0.046 [0.065]
Constant	11.106*** [0.478]	11.012*** [0.641]	11.189*** [0.506]	10.905*** [0.564]
Observations	19	19	19	19
R-squared	0.915	0.915	0.917	0.918
F statistic (prob.)	0.000	0.000	0.000	0.000
D-W d-statistic	2.039	1.970	2.244	1.993
Breusch-Pagan / Cook-Weis. test for heter. (Prob > chi2)	0.745	0.767	0.615	0.757
JB test (Prob.)	0.868	0.888	0.761	0.934
Ramsey RESET test (Prob.)	0.458	0.477	0.528	0.571
Multicollinearity test (vif)	2.27	3.86	2.82	2.37

# Results (with real wages as a proxy for income)

VARIABLES	(1)	(2)	(3)	(4)
	lcons	lcons	lcons	lcons
lrtcpi	-0.786***	-0.730***	-0.846***	-0.747***
	[0.076]	[0.138]	[0.127]	[0.083]
lrwage	0.194	0.207	0.450	0.637
	[1.012]	[1.036]	[1.121]	[1.086]
tcindex		-0.032		
		[0.066]		
tlaw			0.048	
			[0.082]	
aban				-0.077
				[0.071]
Constant	9.980	9.642	8.714	7.137
	[5.849]	[6.024]	[6.344]	[6.376]
Observations	20	20	20	20
R-squared	0.906	0.907	0.908	0.912
F statistic (prob.)	0.000	0.000	0.000	0.000
D-W d-statistic	1.985	1.858	2.171	1.947
Breusch-Pagan / Cook-Weis. test for heter. (Prob > chi2)	0.675	0.694	0.619	0.746
JB test (Prob.)	0.786	0.826	0.7692	0.939
Ramsey RESET test (Prob.)	0.455	0.444	0.486	0.644
Multicollinearity test (vif)	1.54	3.66	2.98	1.88

## Results

- ▶ The only variable, which has significant impact on demand for cigarettes, was real tobacco CPI.
- ▶ Value of estimated coefficients was in the range of -0.73 to -0.85, and the estimated coefficient was stable across different models and different versions of a particular model.
- ▶ This implies that an increase in prices of cigarettes for 1% led to a decrease in the consumption of cigarettes in the range of 0.73% to 0.85%.
- ▶ ARDL model also confirms statistical significance of the increase of cigarettes prices on the decrease in cigarettes consumption.



# Robustness check

- ▶ As the second robustness test, we used the ARDL model to estimate responsiveness of cigarettes consumption to income and price changes.
- ▶ The estimated price elasticity coefficient was in the interval from -0.51 to -0.99
- ▶ Due to the some problems with the ARDL model (did not pass normality test, ...) must be taken with caution.
- ▶ The very short time series is the main cause of the problems that followed our ARDL models.
- ▶ Nevertheless, all ARDL model have confirmed statistically significant impact increase in cigarettes price on decrease in cigarettes consumption.

# Robustness check

- ▶ Also, research that we conducted based on HBS data (for 2011 and 2015) and **Deaton demand model** also indicate a negative price elasticity of **-0.649** (5820 households – smookinh households of 14.298 observed households).
- ▶ The value of the price elasticity coefficient estimated in the model based on macro data is somewhat higher than price elasticity coefficient based on HBS (micro) data.
- ▶ Nevertheless, price elasticity coefficient estimated using both models are in range between -0.5 and 1, which is in line with previous research conducted for low and middle income countries.

# Conclusions

- ▶ Value of estimated coefficients using macro level data was in the range of **-0.73 to -0.85**, and the estimated coefficient was stable across different models and different versions of a particular model.
- ▶ This implies that an increase in prices of cigarettes for 1% led to a decrease in the consumption of cigarettes in the range of 0.73% to 0.85%.
- ▶ Results of our analysis suggest that the state excise policy is an effective tool for reducing smoking prevalence in BiH.
- ▶ If policy-makers in BiH **accelerate dynamics** of increasing excise taxes, the consumption of cigarettes will decrease significantly.

# Thank you for your attention!

For further information regarding BiH please contact as via following adress:

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