Macroeconomic Impacts of Tobacco Taxation in Serbia

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Jovan Zubović & Aleksandar Zdravković

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Correspondence to: Zubović Jovan, Institute of Economic Sciences

Email: jovan.zubovic@ien.bg.ac.rs

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Abstract

Background

To inform the tobacco tax reform discussion in Serbia, it is important to examine its potential macroeconomic impacts. Previous Institute of Economic Sciences studies analyzing tobacco control in Serbia provide valuable insights into the effects of changes in tobacco prices and taxation on consumer demand, government revenue, and illicit trade, among other factors. Nevertheless, no study has yet attempted to build a macroeconomic model that captures intersectoral linkages between the tobacco industry and other sectors in Serbia, which would provide a full-scale estimation of the macroeconomic impacts of tobacco taxation.

Methodology

The methodological framework consists of two building blocks: (i) development of an input-output (I-O) model that captures linkages between the tobacco industry and other sectors in Serbia and (ii) scenario analysis of the increase in tobacco taxation. The I-O model captures the transmission of changes in demand for tobacco products on output, income, and employment in other sectors, which is quantified using respective multipliers. The scenario analysis of the increase in tobacco taxation encompasses three steps: (i) an appraisal of the increase in tax revenues; (ii) an assessment of the change in the structure of household expenditure; and (iii) simulations of the macroeconomic impacts on output, income, and employment.

Results

Two scenarios of increases in tobacco taxation relative to the 2019 baseline price are examined: (i) an increase in the specific tax of 25 percent and (ii) an increase in the specific tax of 43.6 percent to achieve the European Union minimum standard. In both cases the government collects additional tax revenues, due to the inelastic price demand for cigarettes. Simulations show that—even if only 80 percent of the additional tax revenues are reallocated into spending on goods and services that reduce poverty

and improve the welfare of society—the net macroeconomic impacts on output, income, and employment would be positive.

Conclusions

Higher weighting of spending on health services, social work activities, and education, within the structure of additional government revenue from an increase in tobacco taxation, is positively associated with overall net impact on output, income, and employment. Based on the findings from this study, dedicating revenues from tobacco excise taxes for health, social security, and education purposes is suggested as the key policy recommendation.

Introduction

The damage that tobacco use causes to health is indisputable. However, many governments hesitate to pursue tobacco control policies that would reduce tobacco use because of the belief that the harm caused by tobacco may be exceeded by the economic benefits the country gains from growing, manufacturing, exporting, and taxing tobacco products. The macroeconomic impacts of tobacco taxation, in particular, have been the subject of a lasting debate between the tobacco industry and tobacco control policy makers.

In its arguments against taxation, the tobacco industry insists that increases in prices and the subsequent decrease in demand for tobacco products severely affect the national economy due to lost jobs, income, and output. For instance, early industry-sponsored studies in the United States came up with substantial estimates of gross tobacco-related employment (ranging from 2.3 to 3 million) to argue that tightening tobacco control policies would result in a significant loss of jobs (Price Waterhouse, 1992; Tobacco Merchant Association, 1995). Nevertheless, tobacco industry claims have been refuted, and their estimates of employment loss turned out to be overestimated due to the reinvestment of additional tax revenues and reallocation of production factors, including labor and agricultural land, to other activities (Zhang, 2002).

Previous studies on tobacco control in Serbia provide valuable insights into the effects of changes in tobacco prices and taxation on consumer demand, government revenue, and illicit trade, among other factors. Nevertheless, no study has yet attempted to build up a macroeconomic model that captures intersectoral linkages between the tobacco industry and other sectors on the overall level of the national economy. In this paper we develop such a model to run macroeconomic simulations of the envisaged tax policy reforms and, in turn, to quantify the effects that changes in tobacco industry activity would impose on key aspects of related sectors (output, income, employment).

Therefore, findings from this research can be utilized by policy makers for fine tuning of taxation policies in such a way as to maximize the economic benefits to the country.

The rest of the study is organized as follows. The second section summarizes main findings from the empirical studies that examine macroeconomic impacts of tobacco taxation using models of interlinkages between economic sectors. The third section depicts data used and stylized facts on the tobacco industry in Serbia. The fourth section explains the methodological framework for the scenario analysis and simulation of tobacco taxation policies. The fifth section presents the results of the simulations, while the sixth section discusses the main findings from the empirical analysis.

Literature Review & Applied Methods

The two most widely used approaches in estimating the macroeconomic effects of tobacco taxation are input-output (I-O) analysis and computable general equilibrium (CGE) modeling. The basic I-O model can be described as a system of linear equations that presents the economy through sets of interrelationships between sectors themselves (the producers) and others (the consumers) (Koks et al., 2016). Meanwhile, the basic CGE model is a system of equations capturing not only interdependencies between different sectors of a national economy but also the behavioral response of economic agents (for example, profit-maximizing firms or consumption-maximizing households). Both models rely on the input-output tables (or social accounting matrices), which contain transaction values of economic flows. However, CGE models also require knowledge of elasticities that capture the behavioral responses of economic agents.

Since the application of I-O/CGE modeling requires advanced and extensive statistics on national accounts, early studies on the macroeconomic impacts of tobacco taxation modeling were based on computationally less complex I-O modeling and conducted only in advanced countries (McNicoll & Boyle, 1992; Warner et al., 1996; Buck et al.,

1995). The earliest studies based on I-O analysis were mostly focused on the impact of decline in demand for tobacco products on overall employment. An overview of findings from those studies, including increasing data from low- and middle-income countries (LMICs), indicates that, with only a few exceptions, the net employment impact of reductions in tobacco use is positive—that is, the overall number of jobs would increase as the result of tobacco control policies (National Cancer Institute, 2016). The rest of this section presents an overview of findings from some of the most recent studies based on I-O/CGE modeling, mostly in LMIC countries.

I-O studies

Based on I-O tables, Ghaus et al. (2018) indicate that a reduction in cigarette production is likely beneficial for the economy of Pakistan. They recommend that tobacco taxation policy should pursue reducing national tobacco consumption and increasing income to offset the negative health impacts of tobacco use. Findings from a Vietnam I-O case study suggest that increasing tobacco excise taxes positively affects national production and employment while reducing the final demand for tobacco products (Nguyen et al., 2020). The Vietnam study also found increasing tobacco taxes results in net positive gains in national income through increased consumption of non-tobacco goods and services. Similar results were found in a case study of Sri Lanka, indicating that an increase in the tax on tobacco products led to a reduction in tobacco consumption and a surplus of household budget funds, which are redirected towards spending on food and education (Institute of Policy Studies, 2021). According to Bella et al. (2021), an increase in taxes on tobacco products in Indonesia would also generate higher tax revenues, which would positively impact total output, income, and employment.

CGE studies

One of the first analyses of the macroeconomic impacts of tobacco taxation using CGE modeling was conducted in Taiwan (Ye et al., 2006). The authors simulate the introduction of the new tobacco tax scheme, concluding that the cigarette price increase has only a negligible impact on the overall economic structure. CGE analysis in Tanzania shows that lowering the production of tobacco products is likely to negatively

affect employment and wages, so the government needs to assist displaced workers (Jha et al., 2020). However, the reliability of this study's findings is challenged by the fact that most tobacco-related workers are farm workers, and the model does not account effectively for farmers shifting to other crops.

Meanwhile, Huesca et al. (2021) show that an increase in taxes on tobacco products in Mexico not only leads to a reduction in tobacco consumption but also contributes to an increase in government revenue. If these revenues are directed to priority sectors, employment may increase. Similarly, the findings of Sabir et al. (2021) indicate that an increase in cigarette prices results in a significant increase in taxation revenue, the reinvestments of which assure a small but positive overall effect on the economy. According to Cruces et al. (2021), the simulation of a significant increase in taxes on tobacco products in Argentina shows that total employment can even increase in the medium term.

Data and Stylized Facts

Data

In order to examine the macroeconomic transmission of changes in of tobacco production and consumption onto different sectors of the economy in Serbia, this study combines several data sets provided by the Statistical Office of the Republic of Serbia (SORS). Descriptions of each data set follow.

Supply, use, and input-output table

In 2019, SORS for the first time compiled and made publicly available a set of supply, use, and I-O tables for the Republic of Serbia for the year 2015. This set of tables was compiled using the *European System of Accounts ESA 2010* and the *Eurostat Manual for Supply, Use, and Input-Output Tables.* Since the next set of I-O tables (for the year 2020) will be compiled by the end of 2022, for the purpose of this research SORS created the industry x industry I-O table for the year 2019. In addition, for the sake of this research, the regularly produced industry x industry I-O table (comprising 21 NACE

sections of economic activity) is further deconstructed into 88 divisions (2-digit NACE code), which disaggregates the manufacturing section into components, including the tobacco products industry. The stylized 2019 industry x industry I-O table is displayed in Table 1.

Table 1. Stylized 2019 industry x industry I-O table, 2019 basic current prices (million RSD)

	Agriculture	Industry	Services	Total consumption expenditure	Gross capital formation	Exports	Total use
Agriculture	102,888	246,073	97,807	242,232	32,139	133,974	855,114
Industry	179,468	2,437,820	985,264	1,146,579	973,798	1,719,060	7,441,989
Services	111,551	776,996	1,451,610	2,665,379	275,732	767,079	6,048,347
Total intermediate consumption	393,907	3,460,890	2,534,681				
Total intermediate consumption adjusted for taxes less subsidies	424,347	3,572,580	2,704,524				
Value added	322,843	1,387,890	2,774,218				
Total output	747,190	4,960,470	5,478,742				
Import	107,924	2,481,520	569,605				
Total supply	855,114	7,441,989	6,048,347				

Source: Authors' calculation based on SORS data

It is also important to mention that the I-O table is compiled at basic (current) prices, the recommended method by the 2008 System of National Accounts for valuing accounts' output. Basic prices reflect the cost of production—that is, the amount receivable by the producer from the purchaser for a unit of goods or services—minus any taxes payable and plus any subsidy receivable. This creates certain limitations for analysis, as basic prices do not account for VAT or excise taxes. On the other hand, the supply table provides a conversion of supply valued at basic prices into purchasers' prices (prices that include any non-deductible VAT or similar tax payable by the purchaser) for the groups of products. The latter table is therefore utilized to proxy the conversion of basic

into purchasers' prices when the scenario analysis is implemented. Relations between different types of pricing in I-O analysis are presented in Box 1.

Box 1. Pricing in I-O analysis

Basic price: measures the revenue per unit of products sold that remains in the hands of the producer (unit cost of production).

+ Taxes on production (non-deductible)
- Subsidies in production
=
Producer's price: is the price, excluding VAT, that the producer invoices to the trader.

+ Transport charges separately invoiced
+ Wholesalers' and retailers' margins
=
Net-of-tax price: is the price that the trader invoices to the consumer (net of taxes on consumption).

+ Taxes on consumption (VAT, sales taxes, excise taxes)
=
Purchaser's price: is the price the consumer pays for the products (typically retail price).

Note: I-O methodology defines only basic, producer's, and purchaser's price; net-of-tax price here is underscored because of its importance in taxation analysis.

Annual structural business survey and statistics on wages

I-O tables usually contain disaggregation of the gross value added into compensation to employees, consumption of fixed capital, and operating surplus. However, I-O accounting in Serbia is still in an early phase, therefore it does not provide such details. To overcome this issue, two alternative approaches can be used: (i) share of labor costs in value added retrieved from the annual structural business survey (SBS), which monitors financial operations and the structure of economic activities in the non-financial business economy, or (ii) product of annual average gross income and number of employees per industry over respective value added retrieved from I-O table. Apart from the agriculture sector (high unregistered employment), both methods yield similar

estimates. For instance, the estimated share of wages in value added for the tobacco products industry from SBS is 0.24, while the estimate based on annual average gross income is 0.23.

In this study, aggregated cross-industry data from the annual structural business survey are used to approximate missing data on compensation of employees in non-financial economic sectors (the survey does not cover financial sectors). In addition, compensation of employees in financial industries is approximated by the respective annual gross wages.

Employment statistics

Employment in Serbia is tracked by two types of statistics: registered employment and the labor force survey (LFS). The LFS provides a more comprehensive overview of employment (including the informal sector), nevertheless it does not provide data on employment disaggregated to the division level of NACE classification (2-digit NACE code). Therefore, a registered number of employees is used, with the exception of the agricultural sector, where data from LFS are used (due to the large share of informal unemployment in the agricultural sector, there is a significant discrepancy between the number of employees in the register and LFS statistics).

Stylized facts on the tobacco industry and market in Serbia

Serbia is a country with intensive manufacturing of tobacco products. Currently, there are four registered companies for tobacco manufacturing in Serbia: Philip Morris Operations a.d. Niš; British American Tobacco Vranje a.d.; Japan Tobacco International a.d. Senta; and Monus, d.o.o. The peculiarity of the Serbian tobacco industry is reflected in the fact that nearly all locally grown tobacco leaves and large portion of cigarettes manufactured in Serbia are exported. In the structure of agricultural

production in Serbia, production of tobacco leaves has a marginal share, and most domestically grown tobacco is exported (Zubovic et al., 2018).

Table 2 presents recent trends in import, export, and wholesale of cigarette packs in the Serbian market, and Column five provides rough estimates of the cigarette packs produced by the domestic tobacco industry (export + wholesale – import). Despite a steady decline in the quantity of wholesaled cigarette packs, production has increased driven by increases in the export of cigarettes. Therefore, the already high share of cigarette exports is gradually increasing.

Table 2. Recent trends in quantity of cigarettes: import, export, and wholesale (in packs)

Year	Import	Export	Wholesale	Estimated production	Export share
1	*2*	*3*	*4*	*5*	*6*
2018	136,720,494	1,177,077,121	655,508,810	1,695,865,437	69.41%
2019	134,995,074	1,115,563,429	643,571,991	1,624,140,346	68.69%
2020	133,841,726	1,213,416,521	611,308,631	1,690,883,426	71.76%
2021	128,081,940	1,303,377,920	608,184,647	1,783,480,627	73.08%

Source: Tobacco Administration, Ministry of Finance

Table 3. Recent trends in excise revenues on tobacco products (billion RSD)

	Total revenues	Total excises	Excises on tobacco products		
	Value	Value	Value	Share in total revenues	Share in total excise
2017	1,973.4	279.9	99.1	5.02%	35.40%
2018	2,105.3	290.0	99.5	4.73%	34.30%
2019	2,278.6	306.5	105.9	4.65%	34.56%
2020	2,255.0	306.0	108.6	4.82%	35.49%

Source: Treasury Administration, Ministry of Finance

The prevalence rate of smoking in Serbia is among the highest in Europe, despite a considerable decline in recent years from almost 50 percent in 2006 to 37 percent in 2017 (Vladisavljevic, 2021). Therefore, tobacco taxation generates a considerable portion of the nation's tax revenues. Table 3 shows that over the period 2017–2020, while excises on tobacco products generate around 4.8 percent of the country's total annual revenues, they generate 35 percent of the total excise revenue.

Like countries in the European Union (EU), Serbia applies three sorts of tax burden on cigarettes: ad valorem excise (33 percent rate), specific excise per pack of cigarette, and VAT (standard 20 percent rate). Specific excise increases periodically, according to the excise calendar. Table 4 reconstructs the decomposition of the weighted average retail price (WARP) of cigarette packs in 2019. The effective excise burden accounts for 58.8 percent of the retail price, while the total tax burden including VAT accounts for 75.5 percent.

Table 4. Structure of cigarette pack average retail price in 2019

Price decomposition	2019 values (RSD)
Price	274.24
Specific excise	70.75
Ad valorem excise (33%)	90.50
VAT (20%)	45.71
Net-of-tax price	67.28
tax burden	*75.47%*
excise burden	*58.80%*

Source: Authors' calculations

Demand for tobacco products in Serbia is more sensitive to changes in income than changes in prices. Table 5 shows estimates for price and income elasticity for tobacco products based on Household Budget Survey data (Zubovic et al., 2019). When both prevalence and intensity elasticities are counted, the total price elasticity of demand for tobacco products is estimated at around -0.66 (or, a one-percent increase in price implies a 0.66-percent decline in quantity demanded). As an EU member candidate, the Serbian government has been steadily increasing cigarette prices following the harmonization of taxation policy with EU directives. Over the period 2006–2017, prices of cigarettes more than doubled in real terms; subsequently, smoking prevalence and smoking intensity both decreased by about 30 percent, due to the price-inelastic demand (Zubovic et al., 2019). Additionally, smoking households' budget share spent on tobacco products increased from 5.8 percent in 2006 to 9.1 percent in 2017 (Vladisavljevic, 2021).

Table 5. Estimation of tobacco product elasticity in Serbia

Type	Predictor	Estimate
Prevalence elasticity	Price	-0.265
	Income	0.609
Conditional intensity elasticity	Price	-0.395
	Income	0.447
Total demand elasticity	Price	-0.659
	Income	1.058

Source: Zubovic et al. (2019)

Table 6 displays the breakdown of tobacco manufacturing supply from the I-O tables. The table shows that the value of tobacco industry output at basic prices (that is, revenue generated by the tobacco industry) in 2019 was approximately USD 532 million, while the total supply of tobacco industry products was USD 635 million. The first three rows in Table 6 provide the value of tobacco industry inputs supplied from the agriculture, industry (mainly manufacturing), and service sectors. Tobacco industry input from the agricultural sector is considerably lower than input from the other two sectors, as production of tobacco leaves has a marginal share in agricultural production. Within the industry sector that constitutes the major group of tobacco industry inputs, tobacco products dominate; this finding indicates that domestic tobacco manufacturing mostly uses tobacco that has already been processed to a certain degree, thus counting as input from the tobacco industry rather than input from the agricultural sector. Inputs from the service sector also significantly contribute to tobacco products manufacturing—more specifically wholesale services, services of head offices, and management consulting services.

Table 6. Input-output structure of the cigarette industry in 2019, current basic prices

	million RSD	million USD
Agriculture	*4,338*	*37*
Industry	*23,698*	*201*
Services	*16,226*	*138*
Total intermediate consumption	44,262	376
Total intermediate consumption adjusted for taxes less subsidies	52,726	448
Value added	*9,871*	*84*
Total output	62,597	532
Import	*12,092*	*103*
Total supply	74,689	635

Source: Authors' calculation based on SORS data

Tobacco product manufacturing has several distinctive characteristics when compared to the average performance of the manufacturing sector, as illustrated in Table 7. The share of value added in total tobacco manufacturing output is only 16 percent, which is 12 percentage points lower than the manufacturing average.

Table 7. Input-output relations in tobacco products: industry vis-à-vis total manufacturing

Indicator	Tobacco products manufacturing	Total manufacturing (average)
Share of compensation to employees in gross value added	0.24	0.56
Share of gross value added in total output	0.16	0.28
Gross value added per registered employee (in million RSD at 2019 basic prices)	7.78	3.95

Source: Authors' calculations based on SORS data

The share of labor costs in value added is just around 24 percent, more than two times lower than the 56 percent total manufacturing average, indicating that the tobacco products industry is quite capital-intensive. The same conclusion can be drawn when the gross value added per (registered) employee is compared to the manufacturing

average; despite the lower share of value added in output, gross value added per employee is twice as high as the average due to the capital intensity.

Table 8 reconstructs key market relations between expenditures, prices, taxation, and demand for tobacco products in 2019, based on data from supply, use, and I-O tables. Estimated demanded quantity is computed by dividing the household expenditures on tobacco products at purchasers' prices (from the use table) by the average retail price of a cigarette pack (Table 4). The resulting estimate is reasonably close to the wholesale of cigarette packs in 2019 from Table 2. Estimated excise and tax revenues are calculated by applying excise and tax burden rates (Table 4) to household expenditures on tobacco products at purchasers' prices. Again, estimated excise revenues are very close to actual data on excise revenues in 2019 as given in Table 3.

Table 8. Relations between expenditures, demand, taxation, and prices in the tobacco products market, 2019

Variable	Unit	Value
Household expenditures on tobacco products at purchasers' prices (from use table)	Million RSD, 2019 purchasers' prices	186,047
WARP retail price (from Table 4)	RSD/pack, 2019 retail prices	274.24
Net-of-tax price of cigarette pack	RSD/pack	67.28
Estimated demanded quantity	packs	678,409,422
Estimated excise revenues	Million RSD, 2019 purchasers' prices	109,396
Estimated tax revenues (excise +VAT)	Million RSD, 2019 purchasers' prices	140,410
Estimated conversion factor to transform purchasers to basic prices for tobacco products (from I-O and use tables)	Ratio, household expenditures on tobacco industry output at basic prices over household expenditures on tobacco products in purchasers' prices	0.10
Estimated basic price of cigarette pack (output of tobacco industry per cigarette pack)	RSD/pack	27.42
Output of tobacco industry at basic prices	Million RSD, 2019 basic prices	18,602

Source: Authors' calculations

Assuming that the basic price of a cigarette pack approximates the unit production cost, the conversion factor to transform purchasers' price to a basic price for tobacco products (based on data from I-O and use tables) is estimated at 0.1. This finding indicates that tobacco manufacturers retain 10 percent of the retail (purchasers') price. Subsequently, the basic price of a cigarette pack is estimated at 27.42 RSD.

The analysis in Table 8 indicates that I-O representation of the tobacco industry and market highly correlates with actual data, despite high levels of simplification, aggregation, and balancing applied to equalize the supply and demand sides; thus, further analysis on macroeconomic impacts of tobacco taxation might be considered highly reliable.

Methodological Framework

Similar to previous studies on the macroeconomic impacts of tobacco taxation (Ghaus et al., 2018; Bella et al., 2021), the methodological framework consists of two building blocks: (i) development of the I-O model that captures linkages between the tobacco industry and other sectors and (ii) scenario analysis of increase in tobacco taxation. These processes are described below.

Development of the I-O model that captures linkages between the tobacco industry and other sectors

The I-O model captures transmission of the changes in demand for tobacco products on output, income, and employment of the other sectors, which is quantified using two types of multipliers:

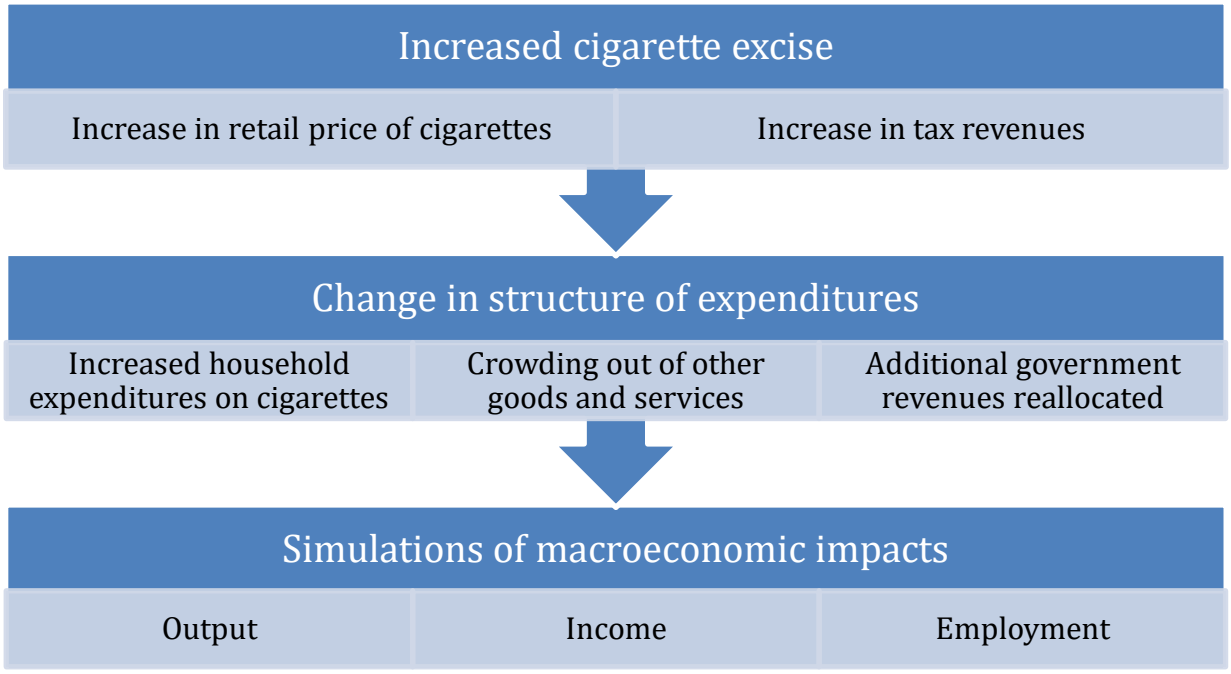
a) type-I (simple) multiplier captures the impacts of changes in final demand on the economy without considering changes in consumption and wages; and
b) type-II (total) multiplier incorporates household consumption and wages of employed labor into the model to compute the consumption-induced effect of the change in final demand.

The arithmetic of multipliers computation is not further elaborated within this study, as it is highly standardized and described in detail in many existing papers (see, for instance, the Scottish Government's 2021 *Input-Output Methodology Guide*[1] for I-O analysis based on the European system of I-O accounting).

Scenario analysis of increase in tobacco taxation

The framework of the scenario analysis and macroeconomic simulations triggered by the increase in tobacco taxation is illustrated by the following scheme (Figure 1).

Figure 1. Scenario analysis framework



The first step in the scenario analysis assumes a "what if" type of scenario analysis based on the specification of two scenarios of tobacco taxation and increases in the price of cigarettes with respect to the 2019 baseline (Table 4). One scenario assumes a moderate increase in specific tax on cigarettes at an arbitrarily selected rate of 25 percent. The second scenario assumes harmonization of the Serbian excise policy on

[1] https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/08/input-output-latest/documents/sut-methodology-guide/sut-methodology-guide/govscot%3Adocument/SUT-Methodology-Guide-v6.2.pdf

cigarettes with the EU directive on taxation 2014/40/EU,[2] which implies around a 43.6-percent increase in specific tax. Table 9 displays detailed the price decomposition in both scenarios. The first scenario yields almost a 13-percent increase in cigarette prices, while the second scenario leads to a price increase of 22 percent.

Table 9. Scenarios of tobacco taxations

Price decomposition	Scenario 1 25% specific tax increase	Scenario 2 43.6% specific tax increase
Price	309.38	335.53
Specific excise	88.44	101.60
Ad valorem excise (33%)	102.10	110.72
VAT (20%)	51.56	55.92
Net-of-tax price	67.28	67.28
tax burden	78.25%	79.95%
excise burden	61.59%	63.28%
Price Increase	**12.81%**	**22.35%**

Source: Authors' calculations

The second step of the scenario analysis assumes that an increase in tobacco product price and excise has a triple effect on change in the final demand. The first effect stems from the change in demand for tobacco products under the given predetermined scenarios, which can be assessed using estimations of price elasticity from Zubovic et al. (2019). As previously discussed, the total price elasticity of demand for cigarettes in Serbia is estimated at -0.659 (Table 5). The change in demand for tobacco products is computed as:

$$Q_t^{TP} = Q_{t-1}^{TP}\left(1 + \epsilon_p \frac{\Delta P_t^{R,TP}}{P_{t-1}^{R,TP}}\right), \quad (1)$$

where Q_t^{TP} is a quantity of tobacco products consumed, ϵ_p is estimated elasticity and $\Delta P_t^{R,TP}$ is supposed relative change in retail price R (assumed to be the same as the purchasers' price from the I-O table). Since the price elasticity is negative, it is clear that

[2] https://ec.europa.eu/health/document/download/c4aa6f75-7e52-463b-badb-cbb6181b87c3_en?filename=dir_201440_en.pdf

demand for tobacco products would decline. On the other hand, less than unit price elasticity (that is, demand for tobacco products is price-inelastic) implies that expenditure on tobacco products would increase despite the shrink in demand,

$$\Delta EXP_t^{R,TP} = \left(P_{t-1}^{R,TP} + \Delta P_t^{R,TP}\right)(Q_{t-1}^{TP} + \Delta Q_t^{TP}) - P_{t-1}^{R,TP} Q_{t-1}^{TP} > 0\ ;$$
$$\Delta P_t^{R,TP} > 0;\ \Delta Q_t^{TP} < 0; \qquad (2)$$

The second effect is related to the so-called crowding-out effect, which occurs when an increase in one category of expenditures must be compensated by a decrease in other expenditure categories due to budget constraints. It can be represented by the simple model of the budget constraint, where $P_t^*$and Q_t^* refers to the synthetic price and quantity of goods other than tobacco products:

$$M = P_t^{R,*} Q_t^* + P_t^{R,TP} Q_t^{TP}, \qquad (3)$$

where M is an income of the household. Assuming price-inelastic demand for tobacco products and no change in income, an increase in cigarette price imposes an overall increase in households' expenditures on tobacco products and subsequent crowding out of some other goods and services. The size of the crowding-out effect $-\Delta EXP_t^{CO;R,*}$ would be equal to the increase in expenditures on tobacco products $\Delta EXP_t^{R,TP}$,

$$-\Delta EXP_t^{CO;R,*} = \Delta EXP_t^{R,TP}. \qquad (4)$$

By keeping price $P_{t-1}^* = P_t^* = P^*$ constant, the crowding-out effect would be reflected through a decline in the demanded quantities of other goods and services:

$$M = P^{R,*}(Q_{t-1}^* + \Delta Q_t^*) + \left(P_{t-1}^{R,TP} + \Delta P_t^{R,TP}\right)(Q_{t-1}^{TP} + \Delta Q_t^{TP});\quad \Delta Q_t^* < 0. \qquad (5)$$

In order to keep the analysis as realistic as possible, the results from the study of Vladisavljevic et al. (2021) are applied to identify the categories of goods and services that most likely would be crowded out. According to the findings of this study (Table 5), food, clothing, health, and education are identified as the categories of goods and services that have the highest chances of being crowded out—that is, relative budget shares for those goods and services would most likely drop following the increase in expenditure for tobacco products.

Table 10. Estimated crowding-out effect of tobacco consumption in Serbia

Product groups	Estimated change in budget shares of households (per unit of tobacco expenditures)
Food	***-0.004****
Clothing	***-0.025****
Housing	0.003
Durables	-0.001
Health	***-0.002****
Transport	0.000
Communications	0.000
Recreation	0.000
Education	***-0.009****
Hotels,	0.009***
Alcohol	0.018***

Source: Vladisavljevic et al. (2021)
Note: *** p<0.01, ** p<0.05, * p<0.1

The third effect is based on the assumption that the government will partially or fully reallocate additional revenues into spending on other goods and services. As illustrated in Box 1, the retail price of tobacco products can be decomposed into net-of-tax price $P_t^{NoT,TP}$ and unit tax burden on consumption TB_t^{TP}:

$$P_t^{R,TP} = P_t^{NoT,TP} + TB_t^{TP}. \quad (6)$$

Assuming that revenues from tobacco taxation are simply computed by multiplying unit tax burden with quantity sold, the change in government revenues from tobacco taxation ΔREV_t^{TP} reads as follows:

$$\Delta REV_t^{TP} = Q_t^{TP} TB_t^{TP} - Q_{t-1}^{TP} TB_{t-1}^{TP}. \quad (7)$$

However, it should be noted that crowding out of other products would reduce government revenues, at least for ad valorem taxation (VAT), so that the net effect on government revenues reads as:

$$\Delta REV_t = \Delta REV_t^{TP} + \Delta REV_t^{*} \quad (8)$$

where ΔREV_t^{*} is computed as the product of the crowded-out quantity of other goods and services and the respective unit tax burden, $\Delta Q_t^{*} TB^{*}$ (it will be a negative value). Assuming that the government will spend at least a certain amount of the additional revenues on goods and services for final consumption (other than tobacco products),

$$\Delta EXP_t^{REV;R,*} = \lambda \Delta REV_t, \quad (9)$$

where λ refers to the portion of additional revenues spent, the total change in expenditures can be written as:

$$\Delta EXP_t^{R} = \Delta EXP_t^{R,TP} + \Delta EXP_t^{CO;R,*} + \Delta EXP_t^{REV;R,*} = \Delta EXP_t^{REV;R,*}. \quad (10)$$

The equation above shows that an increase in the retail price of tobacco products without interference of the government only leads to change in the structure of expenditures on final consumption, through the adjustment of quantities to new relative prices. Since government spending in general is considered as an exogenous variable, it is assumed that government is free to arbitrarily reallocate additional revenues into spending on those goods and services that reduce poverty and improve the welfare of

society, such as agriculture and food production, education and science, and health and social work. Subsequently, two sets of simulations are considered, as shown in Table 11.

Table 11. Simulation assumptions

Simulations	Assumption on amount of additional revenue reallocation	Assumption on structure of additional revenue reallocation
Simulation A	100%	• 50% into agriculture & food production • 25% into education & science • 25% into health & social work
Simulation B	100%	• 25% into agriculture & food production • 50% into education & science • 25% into health & social work
Simulation C	100%	• 25% into agriculture & food production • 25% into education & science • 50% into health & social work
Simulation D	80%	• 50% into agriculture & food production • 25% into education & science • 25% into health & social work
Simulation E	80%	• 25% into agriculture & food production • 50% into education & science • 25% into health & social work
Simulation F	80%	• 25% into agriculture & food production • 25% into education & science • 50% into health & social work

The first set of simulations (A-C) assumes that the government fully reallocates the additional revenues from tobacco taxation on these three groups of goods and services. Since this assumption does not seem particularly realistic, the second set of simulations (D-E) assumes that 80 percent of the additional revenues are reallocated to agriculture and food production, education and science, and health and social work, while the rest of the additional revenue is not reallocated but kept as government savings. Each set contains three simulations that mix shares of the reallocated revenues on designated group of products.

Eventually, the simulated change in expenditures can be applied to the I-O model from the first block to estimate the effects of tobacco taxation on selected macroeconomic indicators—in particular, economic output, household income, and number of employees. To this end, the simulated values of expenditures (Equation 10) at retail (purchasers') price need to be converted into basic prices compatible with the valuations in the I-O model. Since basic prices are not affected by changes in taxation, the change in expenditures on tobacco products can be computed simply as (superscript *B* refers to basic pricing):

$$\Delta EXP_t^{B,TP} = P^{B,TP}\Delta Q_t^{TP}; \quad P^{B,TP} = P_{t-1}^{B,TP} = P_t^{B,TP}, \tag{11}$$

using the values on tobacco products quantity and basic price from Table 8 as inputs. It should be noted that, contrary to the change in expenditure on tobacco products at retail (purchasers') price, the change in expenditure at basic prices is less than zero, as follows from the equation above ($\Delta Q_t^{TP} < 0$).

On the other hand, the change in quantities of other goods and services cannot be explicitly estimated. Therefore, the conversion of crowding-out expenditures and spending of additional revenue are implicitly conducted using conversion factors to transform purchasers' into basic prices $\frac{P^{B,*}}{P^{R,*}}$,

$$\Delta EXP_t^{CO;B,*} = -\Delta EXP_t^{R,*}\frac{P^{B,*}}{P^{R,*}}; \tag{12}$$

$$\Delta EXP_t^{REV;B,*} = \lambda\Delta R_t\frac{P^{B,*}}{P^{R,*}}; \tag{13}$$

The conversion factors for other goods and services can be estimated as ratios of households' final demand for industry output at basic prices over expenditures on industry products in purchasers' prices (as with the tobacco industry in Table 8). Eventually, the change in expenditure at basic prices reads as:

$$\Delta EXP_t^B = \Delta EXP_t^{B,TP} + \Delta EXP_t^{CO;B,*} + \Delta EXP_t^{R;B,*}. \quad (14)$$

Results

Multipliers estimation

As mentioned in the previous section, two types of multipliers can be estimated, depending on whether households' consumption and wages are taken into consideration. Moreover, multipliers can be decomposed to the sum of different effects that change in final demand imposed on macroeconomic indicators. This is illustrated in Box 2 using tobacco products as an example.

Box 2. Decomposition of multipliers

Initial effect: impact of changes in final demand for tobacco products on output, income, and employment in tobacco products manufacturing
+
Direct effect: impact of changes in the final demand for tobacco products on output, income, and employment of input suppliers to tobacco products manufacturing
+
Indirect effect: impact of changes in final demand for tobacco products on output, income, and employment of industries that supply inputs to the industries that supply inputs to tobacco products manufacturing
=
Multiplier type I
+
Consumption-induced effect: impact of changes in final demand for tobacco products on the output of tobacco products manufacturing due to changes in consumption and wages
=
Multiplier type II

Table 12 shows the list of the 10 industries most directly affected by the decrease in tobacco consumption. In total, these 10 industries count for almost 85 percent of the direct effect of the decrease in demand for tobacco products.

Table 12. Intermediate inputs used by tobacco products industry (10 industries with highest direct effects)

Industry	Input value (million RSD)	Direct effect	Contribution (%)
Tobacco products	18,408.63	0.246	41.59
Wholesale trade, except motor vehicles and motorcycles	7,177.00	0.096	16.21
Crop and animal production, hunting, and related service activities	4,313.00	0.058	9.74
Services of head offices; management consulting services	2,184.00	0.029	4.93
Manufacture of paper and paper products	1,347.00	0.018	3.04
Land transport and transport via pipelines	906.00	0.012	2.05
Advertising and market research	872.00	0.012	1.97
Food products	834.00	0.011	1.88
Rental and leasing activities	802.00	0.011	1.81
Manufacture of chemicals and chemical products	717.00	0.010	1.62
Total	37,560.63	0.50	84.86

Source: Authors' calculations according to SORS data
Note: According to the NACE classification, tobacco growing belongs to "Crop and animal production, hunting, and related service activities"

Estimated values of the output, income, and employment multipliers are presented in Table 13. The type-I output multiplier for the tobacco products industry is estimated at 2.18, indicating that an RSD 1 million decrease in final demand for cigarettes (in basic prices) would reduce the economy's output by RSD 2.18 million without taking into account consumption-induced effects. It can be further decomposed to initial effect (unit value), direct effect (0.59), and indirect effect (0.59). The direct effect implies that the output of the industries that provide inputs to the tobacco product industry would reduce by RSD 0.59 million in the case of an RSD 1 million decrease in demand for tobacco products. The estimated value of the indirect effect indicates that an RSD 1 million decrease in demand for tobacco products would result in an additional RSD 0.59 million decrease in output in industries that supply inputs to the tobacco production input-supplying industries.

Eventually, the estimated value of the type-II output multiplier indicates that an RSD 1 million decrease in demand for tobacco products would induce an additional RSD 0.68 million decrease in output, so that total reduction in output would be RSD 2.86 million. The income and employment multipliers can be interpreted in the same manner. The type-II income multiplier indicates that an RSD 1 million decrease in demand for tobacco products would result in an RSD 0.27 million decrease in household income, while the type-II employment multiplier indicates that an RSD 1 billion decrease in demand for tobacco products would result in job loss for 243 employees.

Table 13. Estimated output multipliers

Multiplier type	Output	Income	Employment (per billion RSD)
Initial effect	1.00	0.032	17
Direct effect	0.59	0.074	73
Indirect effect	0.59	0.087	85
Type I (simple) multiplier	***2.18***	***0.193***	***175***
Consumption-induced effect	0.68	0.076	67
Type II (total) multiplier	***2.86***	***0.269***	***243***

Source: Authors' calculations

When the structure of multipliers is scrutinized, several important points can be underscored. The type-I output multiplier is exceptionally high; for instance, values of type-I output multipliers in Pakistan and Indonesia are estimated (using the same methodology) at 1.91 and 1.63, respectively (Ghaus et al., 2018; Bella et al., 2021). On the other hand, the consumption-induced effect in output multiplier type-II is reasonable, as it is the same as Indonesia and even lower than in Pakistan. A possible reason for such a structure of output multipliers in Serbia might be the unusually low share of value added (15.8 percent) in tobacco products industry output, which is quite lower than the share of total value added in total manufacturing output in Serbia (Table 7) and exceptionally lower than the share of value added in the cigarette industry in Pakistan (50 percent). Therefore, it is very likely that the change in final demand for tobacco

products affects intermediate consumption of the tobacco industry more heavily than in countries where value added has a larger contribution to output.

Another important point is the unusual structure of the employment multiplier, wherein the initial effect is very small, so that the type-I employment multiplier is 10 times higher than the initial multiplication. This is a very distinctive feature, considering that the initial effect in Pakistan and Indonesia accounts for approximately half of the type-I multiplier. However, it should be noted that the tobacco products industry in Serbia is highly capital-intensive, thus potential job loss is much more pronounced in industries that supply, either directly or indirectly, inputs to tobacco manufacturing. On the other hand, the income multiplier is relatively low, as the estimated type-II income multiplier is lower than in Pakistan (0.38) and Indonesia (0.4).

Table 14. Top five industries (apart from tobacco products manufacturing) affected by changes in the final demand for tobacco products, based on type-II multipliers

Output				Income	Employment
Industry	**Share**	**Industry**	**Share**	**Industry**	**Share**
Wholesale trade, except motor vehicles and motorcycles	6.58%	Wholesale trade, except motor vehicles and motorcycles	12.95%	Crop and animal production, hunting, and related service activities	24.06 %
Crop and animal production, hunting, and related service activities	5.11%	Crop and animal production, hunting, and related service activities	10.51%	Wholesale trade, except motor vehicles and motorcycles	9.48%
Food products	2.23%	Retail trade, except motor vehicles and motorcycles	4.62%	Retail trade, except motor vehicles and motorcycles	6.72%
Services of head offices; management consulting services	1.78%	Services of head offices; management consulting services	4.41%	Services of head offices; management consulting services	3.27%
Land transport and transport via pipelines	1.63%	Land transport and transport via pipelines	3.33%	Land transport and transport via pipelines	3.25%

Source: Authors' calculations
Note: Shares in type-II multiplier

Table 14 shows which five industries, other than tobacco products manufacturing, are most affected by a change in final demand for tobacco products with respect to output, income, and employment. It is interesting to notice that only five industries are affected, regardless of the macroeconomic performance analyzed (the only exception is food production for output). The two most affected industries are wholesale trade and agricultural production.

Scenario analysis

Following the methodology described in the previous section, the change in expenditures has been projected for both scenarios of a specific tax excise increase. Key results are presented in Table 15. An increase in the specific tax of 25 percent and 43.6 percent relative to the 2019 baseline would result in a decline in the quantity of tobacco products demanded by -8.45 percent and -14.75 percent, respectively.

An increase in price would increase expenditure on tobacco products, that in turn would crowd out some other goods and services. The size of the crowding-out effect is estimated at 3.28 percent of the baseline expenditure on tobacco products (at retail price) for the first scenario and 4.3 percent for the second scenario.

On the other hand, an increase in expenditure on tobacco products would impose an increase in revenues from tobacco taxation. Relative to the 2019 baseline, a 25-percent and 43.6-percent increase in the specific excise would generate 7.1 percent and 10.5 percent additional tax revenues, respectively. Eventually, basic pricing of expenditure on tobacco products shows that the revenue of the tobacco industry would decline by 9.24 percent in the first scenario and 17.3 percent in the second scenario.

Table 15. Key projections under the scenarios of increased tobacco taxation

Variable	Scenario 1 25% specific tax increase	Scenario 2 43.6% specific tax increase
Q_{t+1}^{TP}	621,052,619	578,337,249
$EXP_{t+1}^{R,TP}$	192,141,259,383	194,049,496,991
REV_{t+1}^{TP}	150,350,535,467	155,142,572,844
ΔQ_{t+1}^{TP}	-57,356,803	-100,072,174
ΔQ_{t+1}^{TP} **(%)**	***-8.45%***	***-14.75%***
$-\Delta EXP_{t+1}^{CO;R,*} = \Delta EXP_{t+1}^{R,TP}$	6,094,259,383	8,002,496,991
$-\Delta EXP_{t+1}^{CO;R,*} = \Delta EXP_{t+1}^{R,TP}$ (%)	***3.28%***	***4.30%***
ΔREV_{t+1}^{TP}	9,940,864,567	14,732,901,944
ΔREV_{t+1}^{TP} **(%)**	***7.08%***	***10.49%***
ΔREV_{t+1}^{*}	-1,218,851,877	-1,600,499,398
ΔREV_{t+1}	8,722,012,691	13,132,402,546
$EXP_{t+1}^{B,TP}$	17,029,275,308	15,858,018,980
$\Delta EXP_{t+1}^{B,TP}$	-1,572,724,692	-2,743,981,020
$\Delta EXP_{t+1}^{B,TP}$ **(%)**	***-9.24%***	***-17.30%***

Source: Authors' calculations

To estimate the impact of the crowding-out effect on demanded quantities of goods and services identified in Table 10 (food, clothing, health, and education), we assumed that the decline in quantity would be proportional to the household budget shares in a hypothetical consumer basket that includes only these groups of products. As the study on the crowding-out effect (Vladisavljevic, et al., 2021) is based on COICOP classification of products, while the use table applies SITC classification, we encompassed the following SITC group of products: agricultural products and food products (food), wearing apparel (clothes), basic pharmaceutical products and human health activities (health), and education. Table 16 displays a hypothetical consumer's basket of only crowded-out products, based on household expenditures (at purchasers' prices). As expected, food products have the highest share in expenditures, while education has the lowest share. The last column in Table 16 contains conversion factors necessary to transform purchasers' to basic prices, as required by equations

(12) and (13). It is important to note that the conversion factor for agricultural products is higher than one (implying unit cost of production is higher than unit retail price), which is most likely caused by heavy subsidizing of the agricultural sector. Also, educational and health services are predominately provided by the government free from consumption taxes, therefore their conversion factor is equal to one.

Table 16. Crowded-out goods and services

Product group	Household expenditures in million RSD	Share	Conversion ratio (purchase to basic)
Agricultural products	171,281	15.08%	1.32
Food products	649,756	57.20%	0.48
Wearing apparel	119,952	10.56%	0.45
Basic pharmaceutical products	100,441	8.84%	0.32
Education	44,401	3.91%	1.00
Human health activities	50,027	4.40%	1.00
Total	1,135,858	100.00 %	

Source: Authors' calculations based on SORS data

The assumptions in Table 11 envisage two sets of simulations with respect to the amount of additional revenues from tobacco taxation spent by the government; in the first set of simulations the government spends the full amount, while in the second set it spends 80 percent. Reallocation of 80 percent of additional revenues would result in savings—RSD 1.74 billion and RSD 2.6 billion for the first and the second scenario, respectively—that the government can use for other general purposes.

The rest of this section provides the key results of the simulations according to the type of macroeconomic impact. Simulation details are provided in the Annex.

Impact on output

Figure 2 presents the net impact of the simulations of government revenue reallocation on national economic output under the scenarios of increases in tobacco taxation.

Simulations show that even if only 80 percent of additional tax revenues are reallocated, the change in output would still be positive regardless of the reallocation structure. Overall, a sharp increase in specific tax on tobacco products leads to a higher increase in output, and the maximum effect is achieved in the case of Simulation C2 where 50 percent of the revenues are allocated to health and social work activities. Possible changes in output vary within the range of approximately RSD 4 billion to RSD 16 billion, depending on the scenario and simulated revenue reallocation (values at basic prices).

Figure 2. Simulated net change in economic output under scenarios of tobacco taxation increase, basic prices

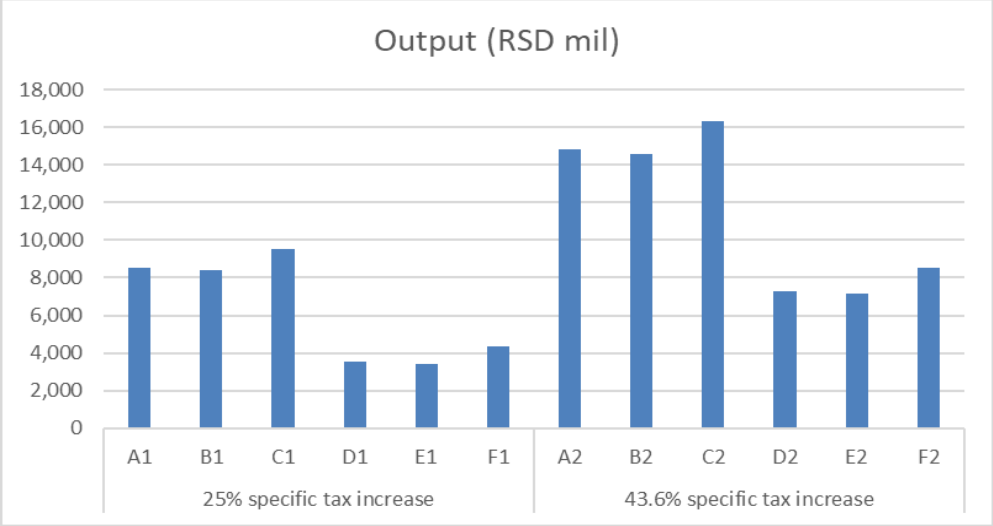
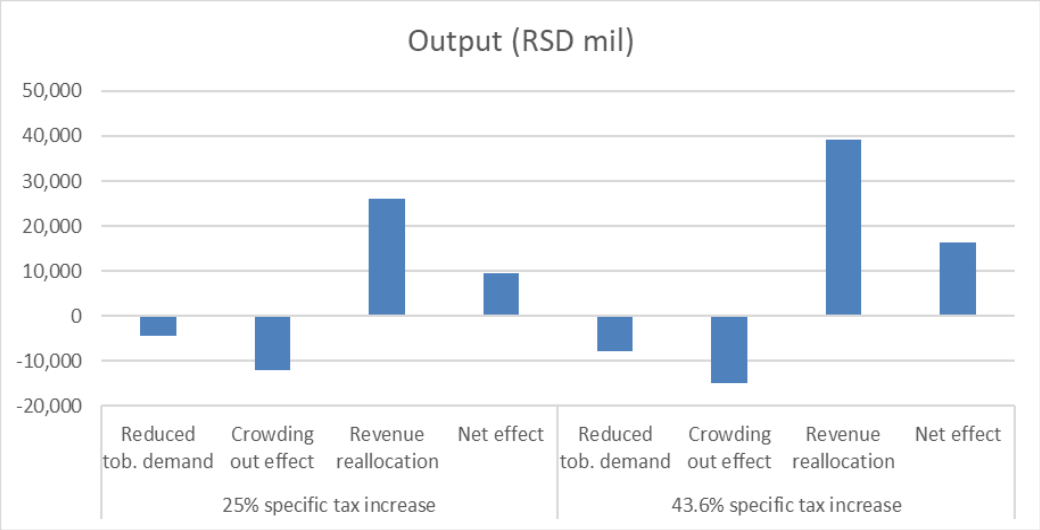


Figure 3 depicts in more detail the optimal reallocation of the additional tax revenues, which is the case of Simulation C (25 percent into agriculture and food production, 25 percent into education and science, and 50 percent into health and social work). Overall change in output is presented by its components in line with Equation (14): effect of reduced demand for tobacco products, crowding-out effect, and effect of revenue reallocation. The effect of reduced demand and the crowding-out effect are prescribed by scenarios and do not depend on simulations; therefore, variations in net effect solely depend on the variations in size and structure of the reallocation. The impact of reduced demand for tobacco products is estimated at RSD 4.5 billion for Scenario 1 and RSD

7.9 billion for Scenario 2. The crowding-out effect is estimated to have a higher contribution to decline in output, RSD 11.9 billion and RSD 14.9 billion for scenarios 1 and 2, respectively. However, both effects are utterly offset by increases in output imposed by the reallocation of the government revenues, so the net effect is positive (RSD 9.5 billion for Scenario 1 and RSD 16.3 billion for Scenario 2).

Figure 3. Net impact of tobacco taxation increase on output in case of optimal revenue reallocation simulation (Simulation C), basic prices



Impact on income

Figure 4 shows the net impact of the simulations of government revenue reallocation on household incomes under the scenarios of increases in tobacco taxation. As in the case of output, no simulation results in a net fall in income. Projected changes in income vary within the range of approximately RSD 1.5 billion to RSD 4 billion, depending on the scenario and simulated revenue reallocation (values at basic prices). The scenario of heavier taxation of tobacco products results in higher projected values of increase in income. Differences in projected values of increase in income between simulations, assuming total reallocation of additional government revenues and only 80 percent of government revenues, are not so pronounced as in the case of output. Overall, Simulation B yields the highest improvement in income. However, the increase in

income imposed by Simulation C is only slightly lower than the optimal income case of Simulation B.

Figure 4. Simulated net change in income under scenarios of tobacco taxation increase, basic prices

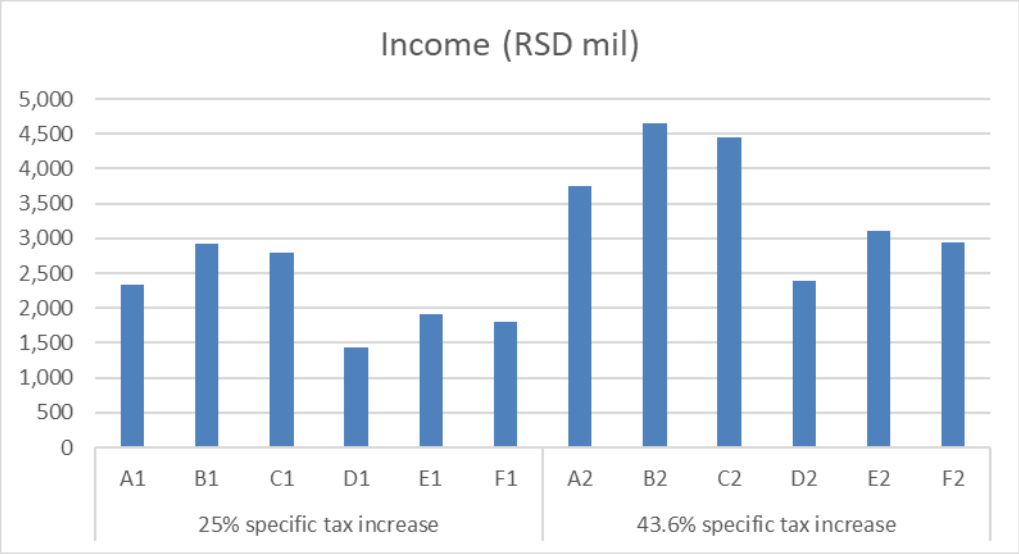
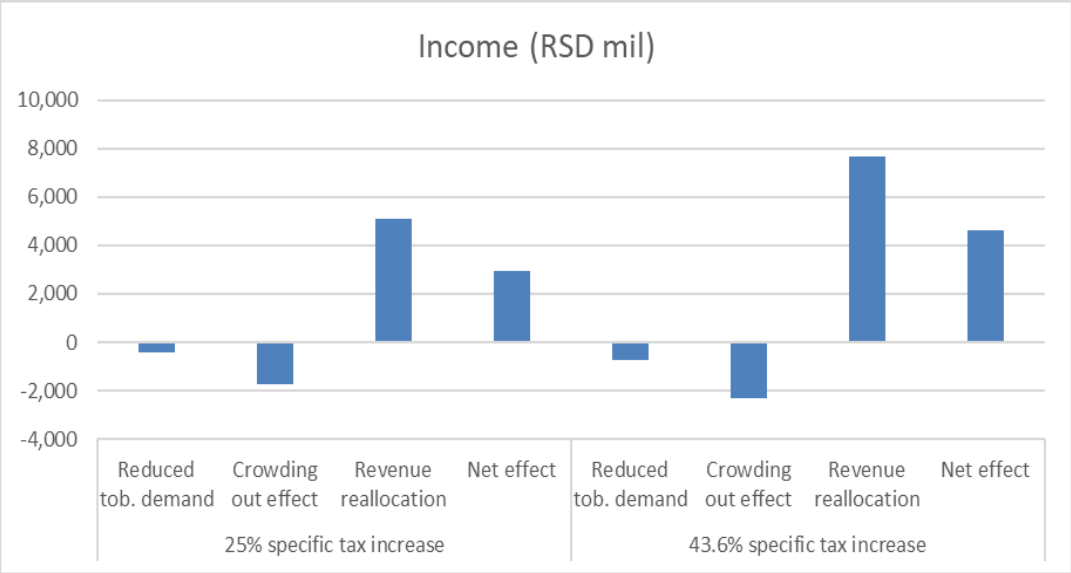


Figure 5 presents in more detail the reallocation of the additional tax revenues that maximizes increase in income, which is the case of Simulation B (25 percent into agriculture and food production, 50 percent into education and science, and 25 percent into health and social work). The impact of reduced demand for tobacco products on income is estimated at RSD 423 million for Scenario 1 and RSD 738 million for Scenario 2. The crowding-out effect is estimated to have a higher contribution to decline in income of RSD 1.7 billion and RSD 2.3 billion for scenarios 1 and 2, respectively. The increase in income after reallocation of additional government revenues is sufficient to compensate for the total loss in income imposed by reduced demand for tobacco products and the crowding-out effect. The net effect of the increase in income is estimated at RSD 2.9 billion for the scenario of a 25-percent increase in specific tax and RSD 4.6 billion for the scenario of a 43.6-percent increase in taxation.

Figure 5. Net impact of tobacco taxation increase on income in case of optimal revenue reallocation simulation (Simulation B), basic prices



Impact on employment

Figure 6 presents the net impact of the simulations of government revenue reallocation on employment under the scenarios of increases in tobacco taxation. Contrary to output and income, change in employment across simulations A-C (100-percent reallocation) and D-F (80-percent reallocation) is quite even for both scenarios. Assuming a 43.5-percent increase in specific tax, Simulation C seems to maximize the increase in employment, but the other two simulation types produce very similar increments in employment. The possible increment in employment varies within the range of approximately 2,000 to 5,000, depending on the scenario and simulated revenue reallocation.

Figure 6. Simulated net change in employment under scenarios of tobacco taxation increase

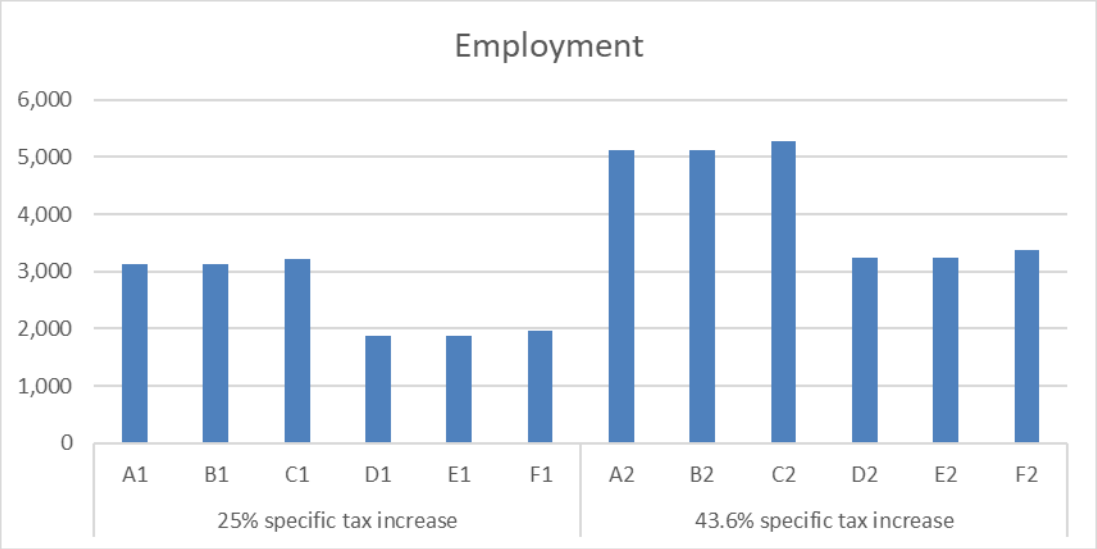
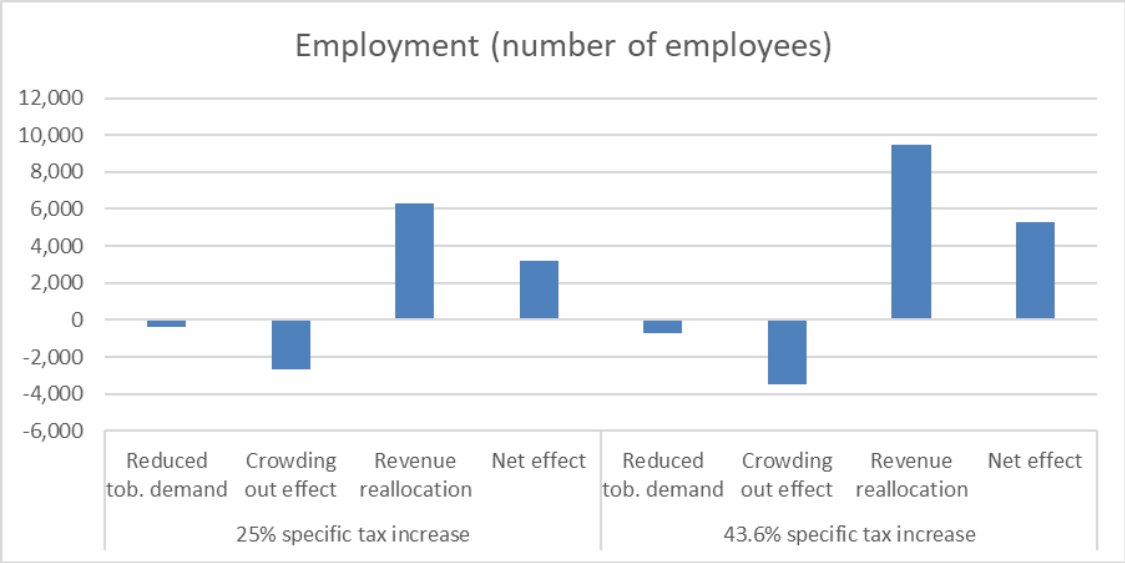


Figure 6 shows in more detail the reallocation of the additional tax revenues that maximizes increase in employment, which is the case of Simulation C (25 percent into agriculture and food production, 25 percent into education and science, and 50 percent into health and social work). The impact of reduced demand for tobacco products on employment is estimated at RSD 414 for Scenario 1 and 722 for Scenario 2. The crowding-out effect is estimated to have a higher contribution to the decrease in employment at RSD 2,655 and RSD 3,500 for scenarios 1 and 2, respectively. The increase in employment after reallocation of additional government revenues is sufficient to compensate for the total loss in employment imposed by reduced demand for tobacco products and the crowding-out effect. The net increment in employment is estimated at 3,228 for the scenario of a 25-percent increase in specific tax and 5,274 for the scenario of a 43.6-percent increase in taxation.

Figure 7. Net impact of tobacco taxation increase on employment in case of optimal revenue reallocation simulation (Simulation C)



When all simulations and estimated impacts on output, income, and employment are jointly considered, simulation C (25 percent into agriculture and food production, 25 percent into education and science, and 50 percent into health and social work) seems to be the most beneficial approach to the reallocation of additional revenues from taxation of tobacco products, regardless of the scenario of increase in specific tax. Simulation C appears as the first choice to maximize positive impact on output and employment, and the second choice in case of impact on income, with a slightly lower effect relative to income-maximizing Simulation B. Apart from economic benefits achieved through multiplication of the change in final demand for tobacco products, Simulation C is additionally beneficial as major reallocation of revenues to health and social work activities has long-term benefits on public health and poverty reduction.

It should be mentioned that the I-O analysis in this study is constrained by several limitations. First, intersectoral linkages in I-O analysis are derived under the assumption of fixed prices, which is an inherent limitation in analysis of the multiplication process. This assumption seems unrealistic, as changes in quantity produced and traded would most likely affect the prices. Second, in this study we simply assume the government spends additional revenues from tobacco taxation on certain goods and services, thus

increasing final demand. However, in the case of education, for instance, it is clear that households are actually the final consumers. Third, we did not consider the final change in government revenues stemming from the changes in output. For instance, an increase in the output of food production yields a considerable amount of taxes on consumption as opposed to education.

Conclusions and Policy Recommendations

This study analyzes the overall economic implications of increases in tobacco taxation on output, income, and employment in Serbia along with expected harmonization of Serbian tax policy with EU directives. To the best of our knowledge, this is the first study on this subject, not only in Serbia but also in the whole region.

Serbia has intensive manufacturing of tobacco products with four companies producing cigarettes. Therefore, it is generally perceived that tobacco manufacturing is important for the Serbian economy in terms of employment, income, value-added creation, and collection of public revenues. However, our study shows that it is not the case; value added and income created by tobacco manufacturing is below the total manufacturing average, while the majority of cigarettes are exported without any taxation nor revenues for the Serbian economy.

In this study, we run simulations of the increase in specific excises on tobacco products to quantify the effects that subsequent changes in the activity of the tobacco industry would impose on the key aspects of the other sectors (output, income, employment). The simulations show that an increase in excise taxes exerts an impact on macroeconomic variables through three channels. The first channel is an increase in household expenditures on tobacco products (due to price-inelastic demand). The second channel is an increase in expenditures on tobacco products crowds out certain goods and services from household consumption. The third channel works through

reallocation of additional government revenues, stemming from heavier taxation, on spending of other goods and services.

The analysis shows that the net impact of an increase in tobacco taxation on output, income, and employment is positive regardless of the assumed structures of government spending, as long as the government reallocates at least 80 percent of the additional revenues from tobacco taxation. Joint consideration of the simulation outcomes indicates that higher weighting of health services, social work activities, and education within the structure of additional government spending is positively associated with overall net impact on output, income, and employment. It is especially important as I-O analysis is essentially static and considers only short- to mid-run economic benefits, not counting second round effects that permanent changes in consumption structure would have over a longer horizon. Therefore, reallocation of the government spending toward reducing poverty, improving the welfare of the society, and strengthening human capital would not only improve macroeconomic performance at once but also produce many positive socioeconomic externalities in the long run, such as reduced medical spending, reduced premature deaths, increased productivity, and a more educated population.

In line with the findings of this study, we propose dedicating increased revenues from higher tobacco excises for health, social security, and education purposes as the key recommendation on tobacco control policy changes. Currently there is no legislation in Serbia that stipulates how government must spend excise revenues. Legal obligation of the government to spend a certain amount of excise revenues on socially desirable outcomes would not be only beneficial from the macroeconomic point of view (as demonstrated in this study), but also to increase support from taxpayers, including those who are smokers, for higher taxation of tobacco products. Therefore, implementation of this recommendation would result in overall short- to mid-term improvements of the macroeconomic performance of the Serbian economy along with positive externalities on public health and associated long-term socioeconomic benefits.

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Appendix

Table A1. Overview of the I-O/CGE studies on tobacco taxation (or decrease in demand for tobacco products)

Authors, country, and model	Scenarios	Assumptions	Estimated impact
Jha et al. (2020) **Tanzania** **CGE**	30% reduction in prevalence	Agricultural land can be used by other agricultural sectors	Minimal damage to the Tanzanian economy due to increases in non-tobacco sectors (0.5 overall decline in employment and 0.3% in output)
Bella et al. (2021) **Indonesia** **I-O**	Cigarette excise taxes increase by 30% and 45%	Tax is fully passed onto consumers Additional government revenues from cigarettes are reallocated to other sectors	Net positive impact in terms of aggregate economic output, employment, and income
Nguyen et al. (2020) **Vietnam** **I-O**	20% and 40% tobacco excise tax increase	No change in government expenditure Laborers could easily move from tobacco-related sectors to other sectors	21 out of 22 sectors in the economy to have net positive gains from tobacco control policies in terms of output and employment
Hueska et al. (2021) **Mexico** **CGE**	Raise the specific tax to 1.35 pesos per cigarette Raise the specific tax to 1.50 pesos per cigarette	All revenue from tax reforms is allocated to the public health sector as a subsidy	No negative impacts on the Mexican economy and instead produces benefits in terms of revenue and public health
Institute of Policy Studies (2021) **Sri Lanka** **I-O**	20% tobacco consumption reduction	Money released from tobacco expenditure would be re-allocated to food and non-food expenditure	Reduced tobacco consumption would yield net positive gains to national income through increased consumption of non-tobacco goods and services
Ghaus et al. (2018) **Pakistan**	Increase in excise reduces individual	The full savings from tobacco would translate into increase in	The simulation results show that consumption switching would increase

I-O	expenditures on cigarette by Rs 1 billion	expenditures on food items Re-allocation of savings from tobacco would be 50% on food and 50% on education	output, income, and employment in the economy, due to the redirection of expenditures towards food
Sabir et al. (2021) Pakistan CGE	An increase of 154.9% in the average price of cigarettes	The increase in government revenues would lead to an increase in investment in the economy	The revenues from cigarettes would increase by 102 percent The overall labor demand in the economy would increase by 0.5 percent
Ye et al. (2006) Taiwan CGE	New tax scheme resulting in overall reduction in tobacco consumption by 18%	All the primary factors of production are perfectly mobile	NT$13.098 billion long-term increase in household welfare opposite an immediate reduction of NT$1.275 billion in GDP and NT$2.217 billion in total investment
Cruces et al. (2021) Argentina CGE	15 percentage points increase in commodity tax on tobacco products	Newly raised tax revenues are spent by the government on education, health, or public infrastructure	Zero net change on overall employment

Table A2. Full list of type-II multipliers and conversion factors used in scenario analyses and simulations

Industry	Output mult.	Income mult.	Empl. mult.	PP to BP CF
Tobacco products	2.87	0.27	0.26	0.10
Crop and animal production, hunting, and related service activities	2.98	0.45	0.83	1.32
Food products	3.32	0.41	0.61	0.48
Wearing apparel	2.59	0.36	0.59	0.45
Manufacture of basic pharmaceutical products and pharmaceutical preparations	1.90	0.18	0.13	0.32
Education	3.49	0.83	0.98	1.00
Human health activities	3.18	0.64	0.77	1.00
Scientific research and development	3.50	0.50	0.42	1.00
Social work services without accommodation	3.27	0.57	0.73	1.00

Table A3. Projections of changes in output, income, and employment in tobacco manufacturing and industries supplying crowded-out products under scenarios of tobacco taxation increases

Industry	Scenario 1			Scenario 2		
	Output	Income	Empl.	Output	Income	Empl.
Crop and animal production, hunting, and related service activities	-3,617	-543	-1,014	-4,749	-713	-1,331
Food products	-5,542	-691	-1,018	-7,277	-908	-1,336
Wearing apparel	-752	-105	-171	-987	-138	-225
Manufacture of basic pharmaceutical products and pharmaceutical preparations	-323	-31	-23	-424	-41	-30
Education	-832	-198	-233	-1,092	-260	-306
Human health activities	-854	-171	-207	-384	-225	-271
Tobacco	-4,507	-423	-414	-7,864	-738	-722
Total	***-16,426***	***-2,163***	***-3,079***	***-22,778***	***-3,023***	***-4,222***

Table A4.1. Simulations type A and D of additional revenue reallocation on output, income, and employment, Scenario 1

Industry	Scenario 1					
	Simulation A1 100% reallocation			Simulation D1 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (25%) and food production (25%)						
Crop and animal production, hunting, and related service activities	8,582	1,288	2,406	6,866	1,030	2,406
Food products	3,466	432	636	2,773	346	636
into education (12.5%) and science (12.5%)						
Education	2,068	906	1,066	1,654	725	1,066
Scientific research and development	3,821	549	455	3,057	439	455
into health (12.5%) and social work (12.5%)						
Human health activities	3,467	695	839	2,774	556	839
Social work services without accommodation	3,565	625	793	2,852	500	793
Total	***24,970***	***4,496***	***6,196***	***19,976***	***3,597***	***6,196***

Note: Output and income in million RSD, basic prices

Table A4.2. Simulations type B and E of additional revenue reallocation on output, income, and employment, Scenario 1

Industry	Scenario 1					
	Simulation B1 100% reallocation			Simulation E1 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (12.5%) and food production (12.5%)						
Crop and animal production, hunting, and related service activities	4,291	644	1,203	3,433	515	1,203
Food products	1,733	216	318	1,387	173	318
into education (25%) and science (25%)						
Education	4,135	1,812	2,133	3,308	1,450	2,133
Scientific research and development	7,642	1,098	910	6,113	878	910
into health (12.5%) and social work (12.5%)						
Human health activities	3,467	695	839	2,774	556	839
Social work services without accommodation	3,565	625	793	2,852	500	793
Total	***24,834***	***5,091***	***6,196***	***19,867***	***4,073***	***6,196***

Note: Output and income in million RSD, basic prices

Table A4.3. Simulations type C and F of additional revenue reallocation on output, income, and employment, Scenario 1

Industry	Scenario 1					
	Simulation C1 100% reallocation			Simulation F1 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (12.5%) and food production (12.5%)						
Crop and animal production, hunting, and related service activities	4,291	644	1,203	3,433	515	1,203
Food products	1,733	216	318	1,387	173	318
into education (12.5%) and science (12.5%)						
Education	2,068	906	1,066	1,654	725	1,066
Scientific research and development	3,821	549	455	3,057	439	455
into health (25%) and social work (25%)						
Human health activities	6,935	1,390	1,678	5,548	1,112	1,678
Social work services without accommodation	7,131	1,251	1,586	5,705	1,001	1,586
Total	***25,978***	***4,956***	***6,307***	***20,783***	***3,965***	***6,307***

Note: Output and income in million RSD, basic prices

Table A4.4. Simulations type A and D of additional revenue reallocation on output, income, and employment, Scenario 2

Industry	Scenario 2					
	Simulation A2 100% reallocation			Simulation D2 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (25%) and food production (25%)						
Crop and animal production, hunting, and related service activities	12,922	1,939	3,622	10,337	1,551	3,622
Food products	5,219	651	958	4,175	521	958
into education (12.5%) and science (12.5%)						
Education	3,113	1,364	1,606	2,491	1,092	1,606
Scientific research and development	5,753	827	685	4,602	661	685
into health (12.5%) and social work (12.5%)						
Human health activities	5,221	1,047	1,263	4,176	837	1,263
Social work services without accommodation	5,368	942	1,194	4,295	753	1,194
Total	***37,596***	***6,770***	***9,329***	***30,077***	***5,416***	***9,329***

Note: Output and income in million RSD, basic prices

Table A4.5. Simulations type B and E of additional revenue reallocation on output, income, and employment, Scenario 1

Industry	Scenario 1					
	Simulation B2 100% reallocation			Simulation E2 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (12.5%) and food production (12.5%)						
Crop and animal production, hunting, and related service activities	6,461	970	1,811	3,433	515	1,203
Food products	2,610	326	479	1,387	173	318
into education (25%) and science (25%)						
Education	6,227	2,729	3,211	3,308	1,450	2,133
Scientific research and development	11,506	1,653	1,370	6,113	878	910
into health (12.5%) and social work (12.5%)						
Human health activities	5,221	1,047	1,263	2,774	556	839
Social work services without accommodation	5,368	942	1,194	2,852	500	793
Total	***37,392***	***7,665***	***9,329***	***19,867***	***4,073***	***6,196***

Note: Output and income in million RSD, basic prices

Table A4.6. Simulations type C and F of additional revenue reallocation on output, income, and employment, Scenario 1

Industry	Scenario 1					
	Simulation C2 100% reallocation			Simulation F2 80% reallocation		
	Output	Income	Empl.	Output	Income	Empl.
into agriculture (12.5%) and food production (25%)						
Crop and animal production, hunting, and related service activities	6,461	970	1,811	3,433	515	1,203
Food products	2,610	326	479	1,387	173	318
into education (12.5%) and science (12.5%)						
Education	3,113	1,364	1,606	1,654	725	1,066
Scientific research and development	5,753	827	685	3,057	439	455
into health (25%) and social work (25%)						
Human health activities	10,441	2,094	2,527	5,548	1,112	1,678
Social work services without accommodation	10,737	1,883	2,388	5,705	1,001	1,586
Total	***39,114***	***7,463***	***9,496***	***20,783***	***3,965***	***6,307***

Note: Output and income in million RSD, basic prices