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Tobacco Taxation Policy

IMPACTS OF TOBACCO TAXATION ON POVERTY AND INEQUALITY IN SERBIA

Tobacconomics Working Paper Series

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Institute of Economic Sciences

No. 24/2/2

Institute of Economic Sciences
Belgrade, Serbia, 2024

ACKNOWLEDGMENTS

Institute of Economic Sciences is funded by Tobacconomics at Johns Hopkins University (JHU) (previously housed at University of Illinois Chicago, or UIC) to conduct economic research on tobacco taxation in Serbia. JHU is a partner of the Bloomberg Philanthropies' Initiative to Reduce Tobacco Use. The views expressed in this document cannot be attributed to, nor can they be considered to represent, the views of JHU, UIC, or Bloomberg Philanthropies.

The authors are grateful for comments from UIC.

Belgrade, February 2024

Abstract

Background

Tobacco tax reform can have varying implications for different groups, depending on their income level. Therefore, it is important to examine its potential impact on poverty and inequality to provide evidence for policymaking. Previous studies on the subject suggest that the effects of increased tobacco taxes in Serbia are progressive and beneficial for the lower-income population. Nevertheless, no study has attempted to measure the impact of increase in tobacco taxation on poverty and inequality using associated indicators grounded in a formal methodological framework.

Methodology

The proposed methodology consists of two building blocks: (i) a scenario analysis to simulate the effects of tobacco taxation on poverty indicators in Serbia, and (ii) a scenario analysis to simulate the effects of tobacco taxation on inequality indicators in Serbia. The poverty metrics applied are based on the Foster-Greer-Thorbecke (FGT) family of indices (headcount ratio, poverty gap, and poverty severity), while the consumption dominance curves (CD) approach is utilized for the sake of simulations. The inequality metrics include the concentration curve and Kakwani index, and income-group elasticities (estimated in previous studies) are used to produce microsimulations of the changes in households' consumption of cigarettes.

Results

Two scenarios of increases in tobacco taxation relative to the 2021 baseline price are examined: (i) an increase in the specific tax of 25 percent and (ii) an increase in the specific tax of 50 percent. Simulations show that an increase in tobacco taxation leads to the very small increase in poverty (e.g. headcount ratio may grow up to 1 percentage point), which can be further reduced by reallocating additionally collected taxes to subsidize consumption of other goods. Regarding impact on inequality, simulations indicated progressivity of increase in cigarette taxation, i.e., higher-income households will spend on cigarettes proportionally more compared to lower-income households in the higher tax scenario.

Conclusion

The main finding of this study indicates that an increase in tobacco taxation in Serbia is progressive but may lead to a small increase in poverty if additional tax revenues are not used to subsidize goods that represent high shares in total consumption of lower-income households. Therefore, our key policy recommendation is to raise tobacco taxation by designing a revenue-neutral tobacco taxation policy, whereby additional revenues from higher tobacco excises would be allocated to subsidize goods and services whose higher consumption would improve the overall wellbeing of society, such as food, education, or health care.

1. Introduction

Tobacco taxation has proven to be the most effective single measure to reduce the demand for tobacco. Increasing taxes on tobacco products leads to an increase in their retail prices, thereby reducing their affordability. This decrease in affordability leads to a decrease in tobacco use, which consequently has a positive impact on public health by decreasing the prevalence of smoking-related diseases and smoking-attributable deaths (Jha & Peto, 2014). Additionally, the increase in tobacco excise tax collection has a positive impact on government revenues.

There are several concerns regarding tobacco tax increases, including possible stimulation of the illicit market, impacts on employment in tobacco-related sectors, and impacts on poverty and/or inequality. When it comes to the illicit market, there is sizeable evidence that the level of corruption and the presence of organized criminal networks are more important factors for the illicit tobacco trade than retail price increases (Shelley, 2018). Concerns about the potential loss of jobs in the tobacco and tobacco-related industries as a result of declines in tobacco use also seem unwarranted, as very few tobacco-related jobs are solely dependent on tobacco. Moreover, any potential loss of jobs in the tobacco industry could be compensated by employment in other sectors that are likely to increase their activity as a result of the redistribution of money formerly spent on tobacco products (Chaloupka et al., 2012).

The issue of poverty and inequality warrants detailed consideration, particularly in Eastern Europe due to a scarcity of rigorous research. Serbia faces significant poverty and inequality challenges, with a considerable portion of its population living below the poverty line and pronounced issues of inequality in income distribution. Furthermore, regional disparities and the rural-urban divide exacerbate the poverty situation, making it crucial to address these inequalities comprehensively. Therefore, consideration of any change in taxation policy or the implementation of tax policy reforms requires comprehensive insight into its potential effects on poverty and inequality.

2. Literature review

Tobacco tax increases can have varying implications for different groups, depending on their income level. In general, the increase in taxes could be seen as regressive since the increase in the retail price of tobacco products imposes the highest burden on those in the poorest group of the population if the poorest

tobacco users continue to use tobacco products at the same intensity as they would need to spend a greater share of their income on tobacco products. Therefore, it is unsurprising that the tobacco industry has consistently used this as an argument for opposing tax increases (Acharya et al., 2016). However, the regressivity of the tobacco tax structure for some smokers does not necessarily mean that the overall effect will be regressive. There is significant empirical support for the notion that increased taxes on tobacco can be progressive rather than regressive (Chaloupka et al., 2000; Chaloupka et al., 2011).

In many countries, particularly those considered low- and middle-income, the prevalence of smokers is disproportionally distributed across income groups (i.e., the highest prevalence is among the poorest) (IARC, 2011). There is also substantial evidence that price elasticity is consistently the highest among low-income populations, meaning they are the most responsive to price and have the highest probability of smoking cessation or at least reducing consumption in response to price increases (Gjika et al., 2019; Najdova et al., 2019; Vladisavljević et al., 2019; Čizmović et al., 2022; Gligorić et al., 2022; Guidon et al., 2023). Therefore, a tax increase is likely to lead to the highest decline of smoking prevalence and consumption among the lower-income part of the population. In the long run, tobacco tax increases also have the greatest impact on preventing lower-income individuals from starting smoking (Bader et al., 2011). Considering these dynamics, the burden of increased taxes falls more heavily on high-income consumers rather than low-income ones (Chaloupka et al., 2012).

Decreasing tobacco consumption among those with the lowest income through tobacco tax increases could also contribute to reducing economic inequality (Acharya et al., 2016). Inequality could be additionally reduced by dedicating the revenue from the tax increase to spending on social welfare services, education, and health care—where, again, the low-income population could benefit the most (not only smokers but non-smokers as well). Of course, low-income individuals who continue to smoke despite increased taxes will inevitably be negatively affected. However, a part of the revenues from the tax increase could be allocated for measures that at least partially mitigate the adverse effects, such as counseling and providing cessation products for low-income individuals interested in quitting smoking (Chaloupka et al., 2012).

Previous findings from Serbia provide support for the notion that the impact of increased tobacco taxes could be progressive. Vladisavljević et al. (2021) reported that there was a significant decrease in tobacco consumption in Serbia from 2006 (49.7 percent smoking households with an average consumption of 39.1

packs per month) to 2017 (34.2 percent smoking households with an average consumption of 27.2 packs per month), which could be seen as a result of the retail price increase by the Serbian excise tax calendar. Based on data on prevalence, consumption, price, and household expenditures on cigarettes, Vladisavljević et al. (2021) provided estimates for total price elasticities. They found the highest elasticity among low-income households (-1.076), a lower one for middle-income households (-0.631), and the lowest for high-income households (-0.220).

A recent study in Serbia (Vladisavljević et al., 2023) that focused on the crowding-out effect of tobacco expenditure at the household level provided some evidence that tobacco tax increases are likely to have multifaceted positive impacts. More precisely, the study observed that the crowding-out effect: 1) is strongest among low-income households; 2) pertains to substantial decreases in the consumption of food, clothing, education, recreation, and cultural activities due to tobacco expenditures; 3) supports the increase of alcohol consumption at the expense of other goods and services; and 4) is likely to be decreased if tobacco taxes are increased and, consequently, tobacco consumption is reduced. Given these Serbia-specific data, one could note that an increase in tobacco taxes is most likely to benefit the poorest population in Serbia.

In recent years, there has been growing interest in a deeper analysis of the progressivity of tobacco taxation and its distributional effects on poverty and inequality, which goes beyond the computation of price elasticity across income groups. The works of Huesca et al. (2021 and 2022) apply more advanced poverty and inequality metrics in order to estimate the distributional impacts of the proposed changes in tobacco taxation policy based on scenario analyses, and these studies confirm the progressivity of tobacco taxation and possible benefits on reduction of poverty in the case of Mexico. The methodological frameworks applied in these two studies represent the basis of the methodological approach in this work; therefore, these studies serve as the benchmark for discussion of the results.

To the best of our knowledge, this is the first study that estimates the impacts of tobacco taxation on poverty in Serbia. However, there are several studies on a similar subject that apply a methodology comparable to the study of Huesca et al. (2021). Adekunle Are (2012) analyzed whether the reform of indirect taxation in Ireland had poverty-reducing effects, coming to the overall conclusion that poverty could be diminished with no loss in revenues by lowering tax on goods with a larger share of consumption by the poor and raising tax on goods with a smaller share of consumption by the poor. Madden (2013)

analyzed the impact of taxing unhealthy food on poverty in Ireland, concluding that a revenue-neutral combination of higher taxes on unhealthy food and subsidies to healthy food may produce a poverty-neutral social outcome. Regarding the impact of tobacco taxation on inequality in Serbia, the abovementioned study by Vladisavljevic et al. (2021) indicated the progressivity of cigarette taxation based on the estimated price elasticities for income groups. However, we are not aware of any study on the subject of tobacco taxation progressivity in Serbia that uses methodology comparable to that applied in our study.

3. Data and methodology

The proposed methodology consists of two building blocks: a scenario analysis to simulate the effects of tobacco taxation on poverty in Serbia and a scenario analysis to simulate the effects of tobacco taxation on inequality in Serbia.

It is important to underscore several issues regarding dynamic analysis of the interactions between poverty/inequality and changes in cigarette prices. The metrics of poverty and inequality are defined with respect to the distribution of the population over the households' income or expenditures. Practically, this means that one needs to know the total income or total expenditure of each household to compute those indicators. A change in price of a certain good clearly leads to the change in consumption of this good at the level of households; however, it is not possible to exactly assess consumption of this good for each household without having information about elasticity defined as a continuous function with respect to income.

Typically, price elasticities are discretely defined with respect to several income groups (often three). But this approach is insufficient for this study for reasons that we will expand upon in this section. Efforts become complicated when the impact of changes in cigarette prices on poverty and inequality are considered: not only do some households reduce their consumption of tobacco, but some households are likely to quit smoking so their expenditures on tobacco drop to zero. This implies that for the proper assessment of the tobacco consumption for **each household** after change in prices, information on both prevalence and intensity elasticities, continuously defined over income, is necessary. Since we are not aware of any methodology to compute such elasticities, some simplifications based on alternative

methodological approaches are needed. In this work we use two such simplifications to provide simulations, which are discussed below.

3.1 Assumptions and data

The same set of tobacco taxation scenarios is applied in poverty and inequality analysis. In particular, two scenarios of tobacco taxation are considered. One scenario assumes a moderate increase in specific tax on cigarettes at an arbitrarily selected rate of 25 percent. The second scenario assumes a sharper increase in the specific tax of 50 percent. The table below displays details of both scenarios. The first scenario yields around a 12.2-percent increase in cigarette prices, while the other scenario leads to a price increase of around 24.4 percent.

Table 1. Scenarios of tobacco taxation

Weighted average retail price (WARP) 2021	**Baseline**	**25% specific tax increase**	**50% specific tax increase**
Price	313.00	351.12	389.24
Specific excise	76.75	95.94	115.13
Ad valorem excise (33%)	103.29	115.87	128.45
VAT (20%)	52.17	58.52	64.88
Net-of-tax (NOT) price	80.79	80.79	80.79
tax burden	74.19%	76.99%	79.24%
excise burden	57.52%	60.32%	62.58%
Price increase		12.18%	24.36%

Source: Authors' calculations based on data from the Tobacco Administration

The primary source of data for this analysis is the Serbian Household Budget Survey for 2021, which is used to compute poverty and inequality indicators, as well as to run simulations on the changes in tobacco consumption to provide necessary inputs for the scenario analysis. In addition, estimates of the poverty thresholds required by poverty metrics are retrieved from the Serbian Statistical Office. Estimates of the price elasticities according to the income groups from Vladisavljević et al. (2021) are used as inputs in

simulations of the change in tobacco consumption. Calculation of the poverty and inequality metrics, as described below, are conducted using the Distributive Analysis Stata Package (DASP) (Abdelkrim & Duclos, 2007).

3.2. Poverty metrics

Poverty metrics are statistical measures used to quantify and assess the extent of poverty within a population. There are a number of aggregate measures of poverty that can be computed, which are typically generalized as the Foster-Greer-Thorbecke (FGT) indices describing a family of poverty metrics, generalized as:

$$FGT(\alpha) = \frac{1}{N}\sum_{p=1}^{P}\left(\frac{z-y_p}{z}\right)^{\alpha} \quad (1)$$

where z is the poverty line (threshold), P is the total number of poor individuals (or households), N is the total population, y is the variable of interest representing the welfare of individuals (usually per capita expenditure or income), and α is a parameter of weighting. The individual indices within the FGT family are derived by substituting different values of the parameter α in the general representation.

In this work, three individual indices within the FGT family are considered as the measures of poverty, depending on the value of weighting parameter α:

a) Headcount index (α=0)**.** Headcount index is by far the most widely used measure, which simply measures the proportion of the population that is counted as poor:

$$FGT(0) = \frac{1}{N}\sum_{p=1}^{P} 1 = \frac{P}{N}, \quad (2)$$

so there is no weighting by the size of the gap between the poverty line and expenditure of the poor population $z - y_p$.

b) Poverty gap index (α=1). The second measure is the poverty gap index, which adds up the extent to which individuals on average fall below the poverty line, and expresses it as a percentage of the poverty line:

$$FGT(1) = \frac{1}{N}\sum_{p=1}^{P}\left(\frac{z-y_p}{z}\right) \quad . \tag{3}$$

The poverty gap index may be thought of as the minimum cost of eliminating poverty using targeted transfers, being simply the sum of all the poverty gaps in a population so that every gap is filled up to the poverty line.

c) Poverty severity index (α=2). Poverty severity index, also known as the squared poverty gap index, is simply a weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gaps themselves:

$$FGT(2) = \frac{1}{N}\sum_{p=1}^{P}\left(\frac{z-y_p}{z}\right)^2.$$

Therefore, by squaring the poverty gap index, the measure implicitly puts more weight on observations that fall well below the poverty line.

The change in the price of cigarettes will effectively change the real income of individuals, affecting the poverty indicators. To re-compute the poverty indicators, knowledge on change in real income for each individual is required, regarding both prevalence and intensity. As discussed before, this is not possible to do in a straightforward way. Consequently, existing studies on the interaction between tobacco consumption and poverty using FGT metrics instead explore issues of secondary poverty—that is, how many people are effectively poor due to smoking (Nguyen et al., 2022; Merkaj et al., 2023), without considering a dynamic (two-period) type of analysis that links changes of cigarette prices and poverty.

Therefore, we rely on the study by Huesca et al. (2021) that utilizes the idea that change in poverty with respect to price can be computed based on partial derivatives of the change in poverty with respect to real income and change in real income with respect to price, using a kernel density estimation approach to generate the distribution of the poverty measure over income space. Obviously, the limitation of such

an approach is that prevalence is not incorporated. However, smoothing the distribution of population over the income space should arguably provide simulations sufficiently similar to discrete-based simulation models.

Some basic notions of dynamic modeling of the relation between price and poverty that is applied in this work are important to consider. Change in the price of certain goods due to an increase in taxation leads to a change in real income and consumption expenditures. FGT poverty indices are sensitive to the change in per capita consumption expenditure, which is referred to as the elasticity of poverty with respect to per capita consumption (Foster et al., 2013). By fixing poverty threshold *z*, the change of the FGT index caused by a change in consumption can be computed by simulations of the change in consumption expenditures around the poverty line.

Such an approach has its limitations, as the conclusion on the change in poverty is valid only for the poverty line neighborhood. However, assuming the continuous distribution of the poverty indicators with respect to the poverty line, an FGT poverty index can be seen as a specific realization of the consumption dominance curves (CD) originally proposed by Makdissi and Wodon (2002), for the fixed value of the poverty threshold. Moreover, the CD approach can be applied to assess the impact on poverty of the revenue-neutral tax reform policy that redirects additional revenues collected from increased taxation of one good to subsidize the other. Since the underlying theoretical background of the CD approach contains a considerable amount of algebra, it is presented separately in the Appendix.

3.3. Inequality metrics

Inequality metrics, also known as inequality indices or measures, are statistical tools used to assess the distribution of income, wealth, or other resources within a population. In this work, inequality analysis is mainly based on the three inequality measures: the Lorenz curve, concentration curves, and the Kakwani index.

- **Lorenz curve –** It is a fundamental graphical tool used in studies of wealth distribution, plotting the cumulative percentage of total income received by the cumulative percentage of the population, offering a clear visual representation of inequality. The distribution of data is

compared to the line of perfect equality, which assumes that each segment of the population has an equal share of income.

- **Concentration curve –** It is a graphical representation that helps analyze the distribution of a specific variable across a population. It is commonly used in economics and social sciences to study income inequality and wealth distribution, but it can also be used to show the distribution of consumption. The concentration curve provides insights into the distribution pattern of the variable across the population. If the concentration curve lies below the line of equality (a 45-degree line), it indicates that the variable is concentrated among a specific group, suggesting inequality.

- **Kakwani index –** It is frequently used to measure the progressivity of some distribution. The Kakwani index can take positive or negative values, where a positive value indicates progressivity (redistribution towards the poor) and a negative value indicates regressivity (redistribution towards the rich). In case of the concentration curve for the consumption of some good, the Kakwani index is calculated as twice the area between the Lorenz curve and the concentration curve. Alternatively, the Kakwani index can be computed as the difference between the concentration index for consumption and the Gini coefficient.

  Similar to the concept of consumption dominance, Kakwani dominance helps evaluate the redistributive impact of different income distribution systems or tax structures by comparing their progressivity. It provides insights into the effectiveness of policies aimed at reducing income inequality and informing decisions on equitable income redistribution. Kakwani dominance is determined by comparing the Kakwani index of one income distribution or tax system to another. If the Kakwani index of one system is always greater (or less negative) than the other for all income levels, then the first system is said to dominate the second system in terms of progressivity.

3.4 Empirical strategy

One of the issues that arises in the estimation of poverty is related to the choice of variables measuring per capita income or per capita expenditure that will properly reflect the welfare of the individuals. Simple normalization of the household income by the number of household members is arguably an ineffective choice, as such a measure of per capita income does not correspond to the household needs. For instance, the need for electricity for a four-member family will not be four times higher than for a single person. Therefore, the OECD suggests the use of the so-called equivalence scale, which adjusts the income to both the size of the household and the age of its members. More specifically, per capita income is equivalized according to a scale that assigns a value of 1 to the first household member, 0.7 to each additional adult, and 0.5 for each child. Our analysis of poverty is fully based on the equivalized income per capita, including the use of the equivalized poverty line. The equivalized poverty line is compiled and computed by the Statistical Office (SORS), and in 2021 it was estimated at 24,064 RSD.

The impacts of tobacco taxation in the proposed two scenarios on poverty are assessed with the following steps:

- estimation of the poverty indicators—that is, FGT indicators for the given poverty threshold—in the baseline scenario;
- estimation of the change in poverty, measured by the selected FGT index for the given poverty threshold, using tobacco CD curves imposed by the scenarios of increased tobacco taxation; and
- assessment of the poverty-improving conditions for the revenue-neutral tax policy reform that envisages redistribution of the additional government revenues from the increase in taxes on cigarettes to subsidies of the out-of-pocket health expenditures.

Regarding inequality analysis, the main issue is zero consumption of cigarettes in non-smoking households. Therefore, analysis of inequality and progressivity of tobacco taxation is limited to only smoking households. For that reason, simulation results obtained in poverty analysis cannot be reused in inequality analysis. Huesca et al. (2022), in their study on the impact of tobacco taxation on inequality in Mexico, used MEXMOD, a Mexico-specific microsimulation model that simulates the impacts of tax change and government cash transfer scenarios on family income in Mexico. As we are not aware of any kind of similar model developed for Serbia, we opt for the simplest solution that utilizes tobacco price elasticities for Serbia from previous studies, which is uniformly applied across respective income groups

to produce simulations. Again, the major shortcoming of such an approach is the inability to incorporate change in prevalence. However, for the reasons argued later, we believe that this limitation does not substantially challenge the main finding on the progressivity of tobacco taxation.

The progressivity of tobacco taxation in two scenarios is assessed by the following steps:

- estimation of the concentration curve of tobacco consumption for the baseline scenario;
- estimation of the concentration curve of tobacco consumption for the scenarios of increased taxation using the microsimulations of the households' consumption, based on the estimated elasticities of tobacco consumption according to the respective income groups; and
- computation of the Kakwani indices for all scenarios and testing Kakwani dominance for the scenarios of increased tobacco taxes.

4. Results

4.1 Impact of tobacco taxation on poverty

The estimated values of the FGT indices of different orders are shown in Table 2. Values are calculated using both equivalized household income and household total expenditures per capita as welfare measures. Estimated poverty indices are higher when income per capita is used. Since differences do not appear considerably large, the further analysis rests on the equivalized income as a measure of welfare. The value of $FGT(0)$ indicates that in 2021, 23.3 percent of the Serbian population had income that is below the poverty line. The poverty gap $FGT(1)$ indicates that the average monthly transfer to each member of poor households needed to eliminate poverty counts as 6.65 percent of the poverty line.

Table 2. Estimated poverty measures

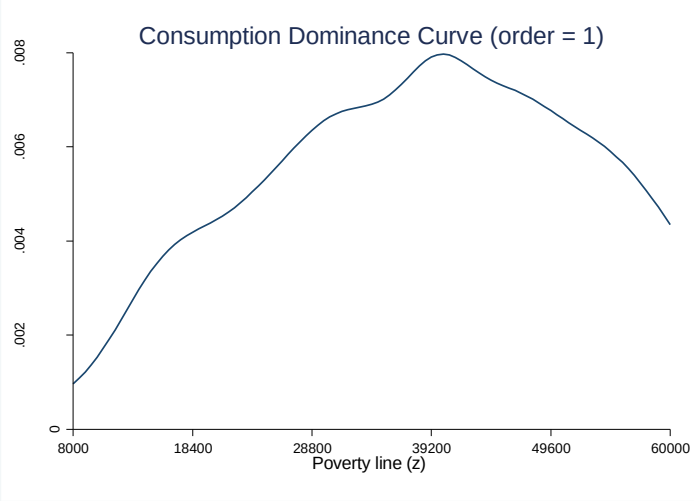
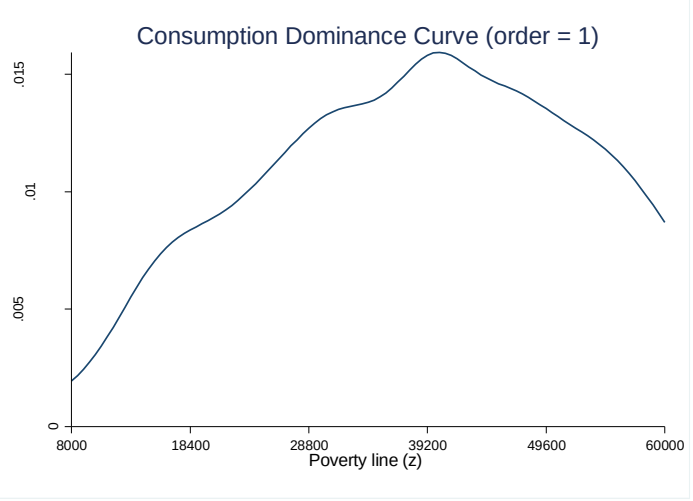
Poverty measure	Eq. HH income per capita	Eq. expenditure per capita
Headcount index – $FGT(0)$	0.2336	0.2277
Poverty gap index – $FGT(1)$	0.0665	0.0567
Poverty severity index – $FGT(2)$	0.0290	0.0212

Source: Authors' calculations based on HBS (2021) data

Note: The poverty line is set to 24,064 RSD based on SORS

First, the impact of an increase in cigarette prices regarding two considered scenarios is analyzed assuming that only the tax on cigarettes is increased. To this end, the consumption dominance curves are estimated in the equivalized income space over the set of possible poverty lines within the arbitrarily chosen interval ranging from 8,000 RSD to 60,000 RSD. Figure 1 displays estimated consumption dominance curves $CD(z, s = 1)$ for scenarios 1 and 2, which correspond to the change in headcount ratio measured by the $FGT(0)$ index. The bell shape of CDs indicates that, with respect to the given income distribution and pattern of cigarette consumption, the change in poverty imposed by the additional cigarette taxation would reach the peak if the poverty line is around 40,000 RSD. Both CDs are above zero over the chosen interval of poverty lines, indicating that an increase in taxation of cigarettes would very slightly worsen overall poverty regardless of the given poverty line, but with the important caveat that this finding is driven by smoking in households that did not decrease their consumption or quit smoking.

Figure 1. Consumption dominance curves for cigarettes

Scenario 1 (12.18% increase in cig. prices)	Scenario 2 (24.36% increase in cig. prices)
	

Source: Authors' calculations based on HBS (2021) data

Table 3 provides particular estimates of the changes in poverty indices in the neighborhood of the official 24,064 RSD poverty line in 2021, as published by the SORS. In the case of the first scenario, a 12.18-percent increase in the price of cigarettes increases the headcount ratio by about 0.5—that is, it very slightly increases the proportion of poor within the total population by 0.5 percentage points. In a similar manner, the change in the poverty gap can be thought of as the change in the relative average transfer needed to eliminate poverty. In the case of scenario 2, a 50-percent increase in specific excise causes a one-percent increase in the headcount ratio. This increase in poverty is very small regardless of the scenario considered and also might be overestimated for the reasons elucidated in more detail in the discussion section below.

Table 3. Estimated change in poverty measures

Change in poverty measure	Scenario 1 (12.18% increase in cig. prices)	Scenario 2 (24.36% increase in cig. prices)

Headcount index – $FGT(0)$	0.516	1.033
Poverty gap index – $FGT(1)$	0.231	0.462
Poverty severity index – $FGT(3)$	0.133	0.265

Source: Authors' calculations based on HBS (2021) data

Note: For poverty line of 24,064 RSD

As Huesca et al. (2021) pointed out:

> clearly, under a money metric utility framework, increasing a tax rate or the price of a given good will translate into lesser individual well-being and could eventually lead to increases in poverty.

However, the good thing is that additional government revenues generated from the increase in tobacco taxation can be used to subsidize some other group of commodities or services that will mitigate or even overcome the increase in poverty. As explained in the Appendix, there is a condition to test whether some tax reform assuming revenue neutrality is poverty-improving. This condition means that the distributive benefits from tax reforms should exceed the efficiency cost of taxation. Roughly speaking, if a subsidized good is denoted as X_l and a taxed good as X_j, distributive benefits reflect a relative change in consumption of X_l over the relative change in consumption of X_l, while the efficiency cost of taxation reflects the relative change in marginal revenue from taxing X_l over the relative change in marginal revenue from taxing X_j. The latter implies that an efficiency cost of taxation higher than one indicates that taxation of X_l is economically more efficient than X_j.

We proceed with the analysis by considering the possibility of mitigating the impact of increased tobacco taxation on poverty by subsidizing out-of-pocket health expenditures (without medicines). To this end, a simple exercise of simulating revenue-neutral tax reform is conducted for both scenarios, following the approach of Huesca et al. (2021). It is assumed that the government is uniformly subsidizing the producers of health care and medication, meaning all the households benefit from those subsidies regardless of their income and poverty status. Out-of-pocket expenditures are computed as a sum of expenditures for medication and health care that are not covered by mandatory health insurance. Since the CD-based approach directly computes change in poverty (see Appendix), it is not possible to explicitely retrieve change in consumption of cigarettes. Therefore, the change in monthly cigarette consumption is computed applying respective income-group price elasticities, which were previously estimated in

Vladisavljevic et al. (2021). Also, we neglect possible cross-price elasticities that may affect demand for other products and marginal revenue in the last instance. The calculation shows that per capita monthly change in government revenues equals 105.64 RSD and 192.8 RSD in Scenario 1 and Scenario 2, respectively (Table 4).

In order to compute the revenue-neutral change in the price of out-of-pocket health items, the required inputs are the own-price elasticity of health products and their cross-price elasticity with tobacco products. The price of out-of-pocket health items was approximated by the average unit expenditure of out-of-pocket health products after the outliers were removed. We are not aware of any study that provides an estimate of such elasticity in Serbia although existing studies indicate that spending on health care and medication is overall price inelastic (Ringel et al., 2002; Ellis et al., 2018; Gatwood et al., 2014), but in some studies, a higher elasticity is presumed (Huesca et al., 2021). Therefore, we arbitrarily assume price-inelastic health spending at -0.3, but also consider higher values of elasticity up to -1.3. The results did not significantly change. The estimated revenue-neutral change in the price of out-of-pocket health items and efficiency cost taxation are presented in Table 4.

Table 4. Scenarios of revenue-neutral tax reform

	Change in monthly per capita cigarette consumption in packs	**Change in monthly per capita government revenues**	**Change in price of cigarettes in RSD (%)**	**Revenue-neutral change in price of out-of-pocket health items in RSD (%)**	**Efficiency cost of taxation γ**
Scenario 1	-0.208	106.93	38.12 (12.18%)	-64.6 (8.89%)	1.06
Scenario 2	-0.417	197.97	76.24 (24.36%)	-121.1 (16.66%)	1.13

Source: Authors' calculations based on HBS (2021) data

Note: Per capita with respect to total population, not only smoking households

Once the efficiency cost of taxation is computed, it is possible to analyze whether poverty dominance conditions of the different orders are fulfilled (condition A.8 in Appendix), which corresponds to a comparison of the distributive effects of tax reform with its efficiency cost. We check these conditions at the poverty line, and the results are presented in Table 5. Considering that the condition for *s*-order

poverty-improving tax reform is that $CD(X_l; z, s) - \gamma CD(X_j; z, s)$, the results in Table 5 indicate that applied revenue-neutral taxation policy in this exercise would not bring about a reduction in poverty at the given poverty line for any combination of scenario and poverty measures. More specifically, the distributive benefit in the neighborhood of the poverty line in both scenarios is only around 0.45, far below the estimated efficiency costs, which in both scenarios are higher than 1.

Table 5. Estimated poverty improvement

Poverty improvement	Condition	Scenario 1	Scenario 2
Headcount ratio	$CD(X_l; z, 1) - \gamma CD(X_j; z, 1),$	-0.003178	-0.006707
Poverty gap	$CD(X_l; z, 2) - \gamma CD(X_j; z, 2),$	-0.001541	-0.003221
Poverty severity	$CD(X_l; z, 2) - \gamma CD(X_j; z, 2),$	-0.000942	-0.001956

Source: Authors' calculations based on HBS (2021) data

Note: Estimates at the poverty line 24,064 RSD

Our results are quite comparable to those obtained by the study on the impact of tobacco taxation on poverty in Mexico by Huesca et al. (2021), which serves as a benchmark regarding the similarity of the subject and methodology. Findings from their study indicate that scenarios of the moderate increase in tobacco excises worsen the headcount ratio in the range of 0.4-1.4 percentage points. Additionally, Huesca et al. (2021) also found low distributional efficiency of the subsidizing health expenditures to conclude that "health care expenses would be little impacted by a public subsidy." Instead, their analysis indicates that subsidizing food products with the highest shares in the consumption basket of poor households would result in poverty-improving outcome.

While subsidizing prices of out-of-pocket expenditures doesn't seem to be a sufficiently effective tax policy measure to reduce poverty, it does not mean necessarily that spending of government revenues on health expenditures is a bad idea. Zubovic and Zdravkovic (2022) show that from the macroeconomic point of view, increased demand for health services has positive effects on economic output, employment, and household income. Therefore, instead of subsidizing the overall price of health care, government can serve as a direct buyer of health services from producers and then distribute them to the poor for free. This might be a good strategy, as data from the Philippines show that increased tobacco tax

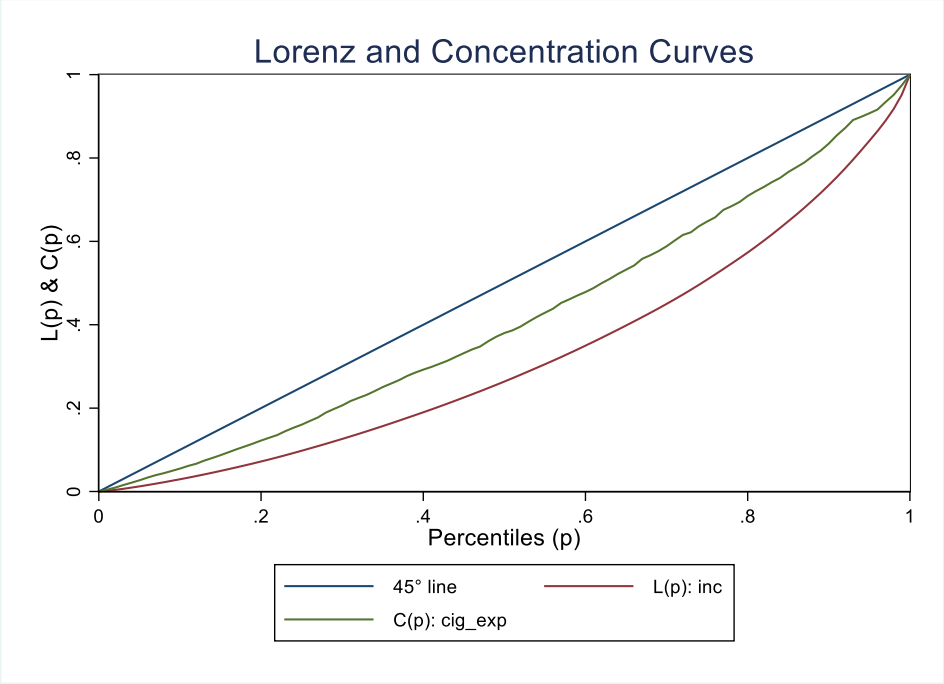
revenues invested into health care led to free health care for the poorest 40 percent of the population (Kaiser et al., 2016), which had positive multiplier effects for the economy and lifted millions out of poverty.

4.2 Impact of tobacco taxation on inequality

The impact of tobacco taxation on inequality is limited to only smoking households—that is, those households that have expenditures on cigarettes. The Lorenz curve (income per capita) and concentration curve (cigarette expenditures per capita) are presented in Figure 2. The more appropriate approach in the analysis of taxation progressivity would be using the tax burden on cigarette consumption, to show the distribution of paid taxes from the poorest to the wealthiest households. Nevertheless, we consider that tax paid on cigarette consumption is proportional to a certain degree to cigarette expenditures, so the findings would not change.

The relation between the Lorenz curve and the concentration curve, as displayed in Figure 2, indicates that tobacco expenditures in Serbia are regressive because the concentration curve is closer to the 45-percent line than the Lorenz curve. In other words, expenditures on cigarettes are more equally distributed than income. The indicated regressivity of tobacco consumption is opposite that of Mexico (Huesca et al., 2022), where the pattern of smoking is different (prevalence is higher in households with higher income), but similar to the case of Turkey (Önder & Yürekli, 2016).

Figure 2. Lorenz curve and concentration curve for cigarette expenditures of smoking households



Source: Authors' calculations based on HBS (2021) data

Note: inc = income; cig_exp = cigarette expenditures

In the next step, we proceed with recalculating the concentration curves for cigarette expenditures assuming a change in prices due to the increase in taxation according to the proposed scenarios. This step requires simulating the change in consumption of cigarettes at the level of households, based on the changes in unit prices (expenditures per cigarette pack). The unit price of cigarettes for each smoking household is increased according to scenario assumptions (38.12 RSD for scenario 1 and 76.24 RSD for scenario 2), and average prices and respective changes are displayed in Table 6.

The total average unit price is slightly lower than the 2021 baseline weighted average retail price (WARP) (Table 1), while the total average change in price (change in average unit price imposed by the scenario simulation) is reasonably close to scenario-wise changes in WARP, indicating that use of unit prices is fully applicable for the sake of this analysis. To get more precise results, change in consumption across income groups is computed using respective income-group price elasticities that were previously estimated in Vladisavljevic et al. (2021). Tobacco expenditures for each smoking household in both scenarios are computed using scenario-related changes in prices and consumption.

Table 6. Simulated changes in average price of cigarettes across income groups

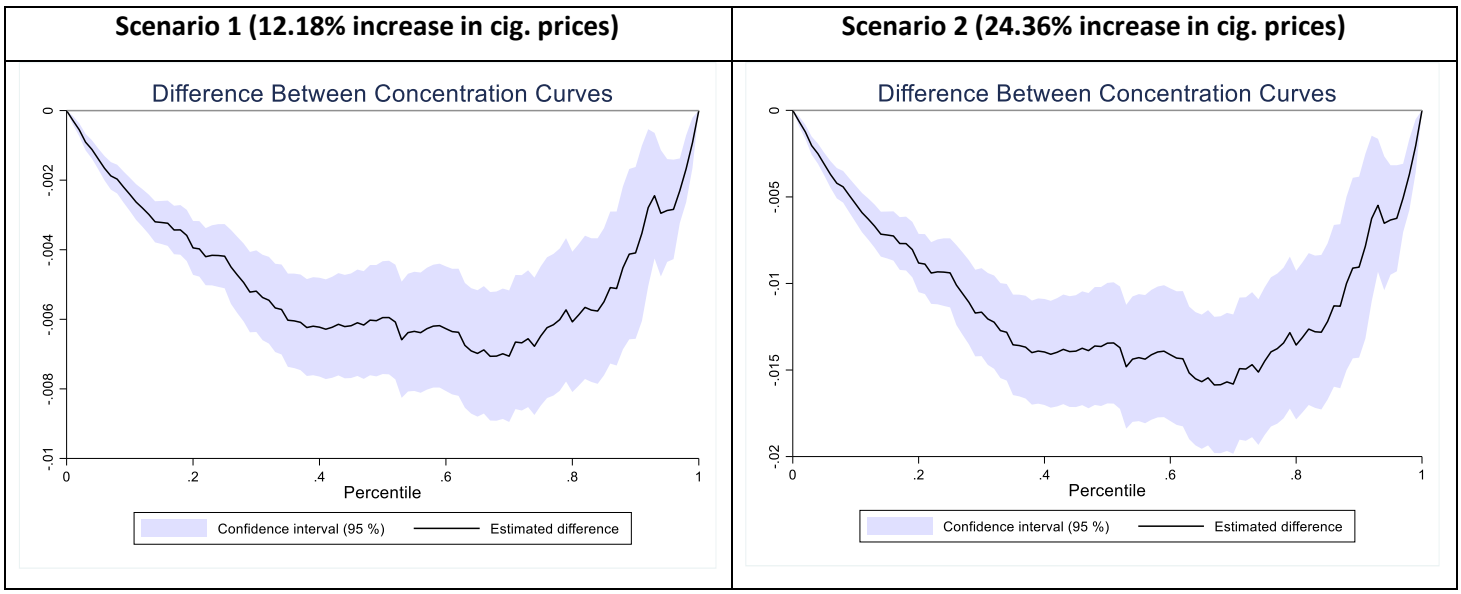
Income group	Cig. price 2021	Cig. price Scenario 1	Cig. price % change	Cig. cons. % change	Cig. price Scenario 2	Cig. price % change	Cig. cons. % change
Low	291.3502	329.4702	13.08	-14.27	367.5902	26.17	-28.55
Middle	299.1704	337.2904	12.74	-8.15	375.4104	25.48	-16.30
Upper	304.3296	342.4496	12.53	-2.79	380.5696	25.05	-5.60
Total	299.4916	337.6116	12.73	-7.41	375.7316	25.46	-14.81

Source: Authors' calculations based on HBS (2021) data

The progressivity of taxation imposes that the concentration curve after an increase in taxation should be farther from the 45-degree line, meaning that cigarette expenditures are more unequally distributed from poor to wealthy households. This further implies that the difference between the concentration curve at the baseline and at tobacco taxation scenarios should be negative.

Figure 3 shows the differences between the concentration curves of the baseline and proposed scenarios. In line with the expectation, differences between concentration curves indicate progressivity of additional taxation of cigarettes. For instance, in the case of scenario 2, Figure 3 shows that cumulative expenses on cigarettes paid by 20 percent of the households at the bottom end of the income distribution will decrease by around one percentage point.

Figure 3. Differences between concentration curves of baseline and proposed scenarios



Source: Authors' calculations based on HBS (2021) data

Note: Cumulative % of population ranked by income on the x-axis

The Gini index represents the size of income inequality, computed as the ratio of the area that lies between the 45-percent line and the Lorenz curve over the total area under the line of equality: more unequally distributed income is represented by a larger area between the equality line and the Lorenz curve, and subsequently a higher value of the Gini index. In a similar manner, the concentration index can be thought of as a measure of inequality in the distribution of expenses, computed in the same way as the Gini index using the concentration curve instead of the Lorenz curve.

Therefore, the regressivity of expenses on cigarettes implies that the Gini index is higher than the concentration index—that is, that the Kakwani index is negative. Table 7 shows the values of estimated Kakwani indices at the baseline and proposed scenarios. It is apparent that the Kakwani index is increasing (less negative), following the increase in the concentration index imposed by the tobacco taxation scenarios. This again confirms the progressivity of tobacco taxation, in line with findings obtained from the visual inspection of the differences in concentration curves from Figure 3.

Table 7. Kakwani index

Scenarios	Gini index	Concentration index (cigarettes)	Kakwani index (Concentration – Gini)	t-stat (p-value)
Baseline	0.3489687	0.1703343	-0.1786345	-11.3702 (0.000)
Scenario 1		0.1799473	-0.1690215	-10.5156 (0.000)
Scenario 2		0.1918782	-0.1570905	-9.50641 (0.000)

Source: Authors' calculations based on HBS (2021) data

5. Conclusions and recommendations

The main finding of this study indicates that an increase in tobacco taxation in Serbia is progressive, but may lead to a small increase in poverty in both of the scenarios presented here. As microeconomic theory and existing literature suggest, an increase in taxation of any normal good (with negative price elasticity)—that is not compensated by a decrease in taxation of some other good—effectively reduces the real income of consumers. However, there is a reasonable argument that the estimated increase in poverty is not substantial.

First, the estimated changes in the headcount ratio (poor to total households) are relatively small, ranging from around 0.5 pp. to 1 pp. in scenarios 1 and 2, respectively. Second, as mentioned before, the major drawback of our analysis is the impossibility to estimate change in prevalence at the level of individual households. Since the estimation of the change in poverty indicators is based on smoothing out the density of the population over income space, it is very likely that the increase in poverty is overestimated, keeping in mind that prevalence elasticity in Serbia is considerably higher for households with lower income. Third, more substantial increases in tobacco taxation relative to those presented in the scenarios here may even reduce poverty due to the sharp decrease in prevalence; however, it could not be properly modeled using the approach that we apply in this study.

On the other hand, though cigarette expenditures are regressive with respect to income distribution, strictly speaking, an increase in taxation works in a progressive way, making cigarette expenditures more unequally distributed in favor of smoking households with lower incomes. More specifically, the progressivity of cigarette taxation means that higher-income households will spend proportionally more

compared to lower-income households in the higher tax scenario. The fact that we could not estimate change in prevalence should not undermine our finding; in fact, it is likely that we underestimated the reduction of inequality, considering that prevalence is considerably more elastic for lower-income households. Moreover, Huesca et al. (2022) estimate the ratio of tobacco burden across income groups with and without households that quit smoking after the simulation of an increase in tobacco taxation, using a more advanced methodology of microsimulation, but their results indicate only slight differences in tax burden among those two cases, regardless of the income group. Estimated values of the Kakwani index in our study indicate that a higher increase in taxation leads to a greater decrease in inequality (because the value of the Kakwani index in scenario 2 is higher than in scenario 1). This implies that inequality will be reduced even with more substantial increases in tobacco taxation. Our results are also in line with Vladisavljevic et al. (2021) which find that increasing tobacco excise taxes in Serbia redistributes the tobacco tax burden from low- to high-income households.

An important issue that arises from this analysis is whether the small change in poverty due to the rising taxes on cigarettes can be fully offset or even reversed by subsidizing some other goods or services. We conduct the exercise of the simple revenue-neutral tax reform in which additional revenues collected from higher taxation of tobacco are used to subsidize out-of-pocket health spending, without medicines. The result of the exercise shows that subsidizing health expenditures substantially reduces the increase in poverty imposed by the higher taxes on cigarettes at no additional budget costs, but this reduction is not sufficiently large to fully compensate for the change in poverty. The most likely reason why policy reform that includes subsidizing health spending eventually does not result in the socially desired outcome is a relatively low share of out-of-pocket health expenditures in consumption baskets of poor Serbian households. This is in line with conclusions from similar studies on the subject: that subsidizing the goods with higher shares of consumption by the poor will more likely offset an increase in poverty caused by the higher indirect taxation of some other goods.

Apart from the major drawback of our study—the impossibility of explicitly handling change in prevalence at the level of individual households—there are some other limitations of a more technical nature. First, it is not possible to take into account regional variations in the standard of living, which are very pronounced in Serbia. Variation in the standard of living means that a single average poverty line does not properly reflect the poverty of consumers with respect to their real income. In this regard, a possible improvement would be an adjustment of incomes for the regional price indices. Second, in the analysis of

inequality it is only possible to use cigarette expenditures—instead of the tax burden concentration curve, which would be more accurate.

In line with the findings of this study, we propose as our key policy recommendation designing a revenue-neutral tobacco taxation policy, whereby additional revenues from higher tobacco excises would be allocated to subsidize other goods and services. As indicated by the simulation results, tobacco taxation is progressive, so that any increase in taxes will reduce inequality. Hence, a key aspect of a well-designed tobacco taxation policy in Serbia should be the redistribution of additional tax revenue to avoid or minimize any negative impact that the increase in taxes may have on poorer smokers who struggle to reduce their tobacco consumption. The choice of goods to be subsidized is a challenging task since the final effect of subsidies on poverty will largely depend on consumption patterns of subsidized goods, including own- and cross-price elasticity of demand and share in total consumption of poor households. Therefore, designing such a reform requires a strict evidence-based approach, with careful examination of the consumption patterns of goods and services whose higher consumption would improve the well-being of society overall (such as food, education, or health care).

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Appendix

Theoretical framework for modeling the impact of indirect taxation on poverty

The methodology used in this study to assess the impact of taxation on poverty utilizes concepts of equivalent income, money metric utility function, stochastic dominance, and consumption dominance curves, following the work of King (1983), Besley and Kanbur (1988), Foster and Shorrocks (1988), Makdissi and Wodon (2002), and Duclos et al. (2008). Since the underlying theoretical framework contains a considerable amount of algebra, it is streamlined here for the sake of expositional simplicity.

In line with common microeconomic theory, let us assume an individual with income y whose preferences may be represented by the utility function $u = u(x)$, where x is a consumption bundle. For a given set of prices q and income y, the indirect utility function maximizing level of x reads as $v = v(y, q)$, while the expenditure function minimizing the cost of obtaining a particular utility level u reads as $m = m(u, q)$. When the prices are fixed, the expenditure function boils down to the monotonic transformation of the utility function, thus representing utility in monetary terms, commonly referred to as the money metric utility function. Since the expenditure function and indirect utility function are inverses of each other, the money metric utility function is often called the minimum income function, as it gives the minimum cost of obtaining the utility of the vector x when prices are q.

The money metric utility is further exploited by King (1983) for the sake of comparing the levels of an individual's welfare when they face different consumption possibility sets, with respect to some arbitrarily chosen set of reference prices q^R. King introduced the concept of equivalent income y^E as an income that affords the same level of utility at the reference price vector as can be afforded under the budget constraint (y, q), $v(y^E, q^R) = v(y, q)$. Subsequently, equivalent income can be rewritten as a function of the remaining arguments from the previous equation, $y^E = y^E(y, q, q^R)$. The equivalent income is then interpreted as a monetary measure of the individual's welfare—that is, it indicates the amount of money necessary to keep an individual's well-being under the given set of reference prices. Therefore, equivalent income can be thought of as the real income, since a marginal change in price would indicate a change in consumer welfare.

The concept of equivalent income is utilized by Besley and Kanbur (1988) to develop a framework for analysis of the impacts of taxation on poverty that was further extended by Makdissi and Wodon (2002) and Duclos et al. (2008). Within this framework, it is assumed that producers' prices are fixed, so that the price of each commodity equals the sum of producer price e_i and respective tax rate t_i, $q_i = e_i + t_i$; the latter implies that $dq_i = dt_i$. Assume that income y is distributed according to certain probability function $F(y)$ over the interval $(0, Y)$. The contribution of an individual with income y to the total poverty is measured by the function $p(y^E, z)$, where z is a given poverty line defined in the equivalent income space. Integration of poverty measure over y^E provides the additive poverty index,

$$P(F, y) = \int_0^Y p(y^E, z)\, dF(y), \quad z < Y, \tag{A1}$$

so that the contribution of individuals with equivalent income higher than the poverty line equals zero.

If the government decides to change the taxation of some commodity, it will affect equivalent income through changes in price and, eventually, the poverty measure through changes in equivalent income. Suppose that a set of reference prices is set to the pre-reform prices, $q^R = q$, which further implies that $y^E = y$. In that case, Besley and Kanbur (1988) show, using Roy's identity, that changes in equivalent income imposed by a marginal change in taxation can be computed as:

$$\left.\frac{dy^E}{dt_i}\right|_{q^R = q} = -x_i(q, y), \tag{A2}$$

where $x_i(q, y)$ is a Marshallian function of demand for good i. As noted by Duclos et al. (2008), the previous equation states that:

> observed pre-reform consumption of good i is a sufficient statistic to know the impact on consumer welfare of a marginal change in the price of good i.

Going back to the poverty measure, a change in poverty imposed by a marginal change in taxation reads as:

$$\frac{dp}{dt_i} = \frac{\partial p}{\partial y^E}\frac{dy^E}{dt_i}, \tag{A3}$$

when (A2) is inserted into (A3), and the RHS of the equation is multiplied and divided by the per capita consumption of good *i* denoted as X_i, total change in poverty measure can be rewritten as:

$$dp = -X_i dt_i \frac{\partial p}{\partial y^E} \frac{dy^E}{dt_i} CD(i; y, 1). \quad \text{(A.4)}$$

Makdissi and Wodon (2002) introduced the concept of the consumption dominance curve of the order s, $CD(i; y, s)$, where $CD(i; y, 1) = x_i / X_i$ and $CD(i; y, s) = \int_0^y CD(i; y, s-1)$ for orders $s > 1$. Subsequently, a change in the additive poverty index $P(F, y)$ is obtained by integrating over y,

$$\frac{dP}{dt_i} = -X_i dt_i \int_0^Y \frac{\partial p}{\partial y^E} \frac{dy^E}{dt_i} CD(i; y, 1)\, dF(y). \quad \text{(A.5)}$$

This can be generalized for any order s. If the higher orders of income distribution F are defined as $D(z, s) = \int_0^z D(y, s-1)dy$, $D(z, s) = F(z)$, they can be expressed in the form of stochastic dominance curves of the order s as $D(z, s) = \frac{1}{(s-1)!} \int_0^z (z - y)^{s-1} dF(y)$ (Davidson & Duclos, 2000). As noted by Duclos et al. (2008), dominance curves are just sums of powers of poverty gaps, which can be easily related to the $FGT(z, \alpha)$ poverty indices since $FGT(z, \alpha) = \alpha!\, z^{-\alpha} D(z, \alpha + 1)$. Furthermore, a CD curve for some good k can be also linked to the $FGT(z, \alpha)$ through a stochastic dominance curve, since

$$CD(k; z, s) = \frac{\partial D(z, s)}{\partial t_k}. \quad \text{(A.6)}$$

This is a convenient feature of CD curves, as they can be used to compute impacts of a marginal increase in the price of good k on the $FGT(z, \alpha)$.

Use of CD curves to analyze impacts of indirect taxation on poverty can be easily extended to comprise revenue-neutral taxation policy in which additional revenues from higher taxation of one good are used to subsidize consumption of some other. Assume that the taxed good is X_j and the subsidized good is X_l; the revenue-neutral condition of tax reform is then imposed as (see, for instance, Makdissi & Wodon, 2002):

$$dt_j = \gamma \left(\frac{X_l}{X_j} \right) dt_l, \; \gamma = \frac{X_l + \sum_{k=1}^{K} \frac{\partial X_k}{\partial t_l}}{X_l} \Big/ \frac{X_j + \sum_{k=1}^{K} \frac{\partial X_k}{\partial t_j}}{X_j}, \quad \text{(A.7)}$$

where K stands for the total number of goods consumed. The coefficient γ in this context represents the efficiency cost of taxation—that is, it indicates deadweight loss from taxation. Makdissi and Wodon (2002) further show that for any additive poverty index of order s, a sufficient and necessary condition to be poverty-improving ($dP \leq 0$) over the selected interval of poverty lines $z < z^+$ is:

$$CD(l; z, s) - \gamma CD(j; z, s) \geq 0, \quad \forall z < z^+. \quad \text{(A.8)}$$

The relation between CD curves may be considered as a measure of the distributional benefit of taxation (Huesca et al., 2021), so the condition (A.8) can be alternatively interpreted as stating that a poverty-improving neutral tax reform is achieved if the distributional benefit is equal to or higher than the efficiency cost.

If the condition (A.8) is fulfilled, it can be stated that neutral tax reform is s-order poverty-improving, following the concept of poverty ordering (Foster & Shorrocks, 1988). In the case of the FGT class of indices, it is easy to comprehend that first-order poverty-improving means diminishing the proportion of the poor in the total population for the given poverty line (that is, a fall in headcount ratio) and so on. Ordering higher than $s = 3$ are rarely used in poverty analysis.