WPS8227

Policy Research Working Paper 8227

Regressive or Progressive?

The Effect of Tobacco Taxes in Ukraine

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WORLD BANK GROUP
Poverty and Equity Global Practice Group
October 2017

Abstract

Tobacco taxes are usually considered regressive, as the poorest individuals allocate larger shares of their budget toward the purchase of tobacco-related products. However, because these taxes also discourage tobacco use, some of the most adverse effects and their economic costs are reduced, including lower life expectancy at birth, higher medical expenses, increased years of disability among smokers, and the effects of secondhand smoke. This paper projects the effects of an increase in the tobacco tax on household welfare in Ukraine. It considers three price-elasticity scenarios among income deciles of the population. The results show that although tobacco taxes are often criticized for being regressive in the short run, in a more comprehensive scenario that includes medical expenses and working years, the benefits of tobacco taxes far exceed the increase in tax liability, benefitting in large measure lower income households. The results also indicate that lower health expenditure seems to be the main driver, because of the reduction in tobacco-related diseases that require expensive treatments. Tobacco taxes are also associated with positive distributional effects related to the higher long-term price elasticities of tobacco consumption.

This paper is a product of the Poverty and Equity Global Practice Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at afuchs@worldbank.org.

Regressive or Progressive? The Effect of Tobacco Taxes in Ukraine

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JEL Codes: H23, H31, I18, O15

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1. Introduction

On December 19, 2016, the Ukrainian Parliament approved the 2017 budget, which includes a specific excise tax on tobacco products that represents a 40 percent increase over the corresponding tax in 2016, while maintaining a 12 percent ad valorem tax. Because low-income families usually allocate a larger proportion of their budgets to purchase tobacco products and alcoholic beverages, the tax increase would seem to be a regressive policy at first glance. However, a closer look reveals that the expected overall reduction in tobacco consumption[2] associated with the tax increase would -in the long run- reduce the adverse effects of tobacco consumption, including higher medical expenditures and added years of disability among smokers, the negative effect on life expectancy at birth, reductions in the quality of life, and numerous negative externalities among first- and secondhand smokers, thus benefiting former smokers and their families. Meanwhile, a boost in government revenue (paid by those who continue to smoke) earmarked toward providing social transfers (such as health care or pensions) could further lever the benefits of a tobacco taxation for the poorest households. The increase in the tobacco tax and the subsequent reduction of tobacco consumption could therefore result in potential measurable benefits for different income groups.

This paper describes and quantifies the effects of tobacco tax increases on aggregate household welfare through three channels. Channel (1) implies that higher tobacco prices due to higher taxes induce behavioral response in the means of a reduction on tobacco consumption.[3] The reduction in consumption is then associated with (2) a reduction in medical expenses, and (3) a rise in income because of the gain in years of employment. To assess the impact of these effects, this paper estimates the price elasticity of tobacco, simulates upper- and lower-bound scenarios, and calculates the welfare gains among various population income groups.

There is ample and robust evidence linking tobacco consumption with health-related problems.[1, 2] Diseases associated with tobacco use range from lung cancer to stroke and even to congenital malformation in children.[3] In 2010, 7 million early deaths were attributed to tobacco consumption globally.[4] Today, more than 80 percent of the world's smokers live in low- and middle-income countries, harming health, incomes, earning potential, and labor productivity and undermining human capital accumulation, which is critical to sustainable economic growth and social development.[5] In Ukraine, 85,000 deaths are attributed to tobacco consumption yearly.[6] Evidence linking tobacco and health problems has triggered important policy shifts among international organizations and policy makers alike, leading to more rigorous restrictions and taxation on the sale and use of tobacco.

Accordingly, the World Health Organization (WHO) has made the reduction of tobacco consumption one of its primary goals, thus promoting tobacco monitoring, smoke-free policies, smoking-cessation support programs, relevant health advice, advisory deterrents, and taxation policies.[7] Among strategies, the tobacco tax seems to be one of the most efficient measures for reducing tobacco consumption and has the added benefit of raising government revenue.[8] The inelastic demand of some tobacco consumers is useful in increasing tax revenues, and the higher price elasticity of younger smokers makes the tax an efficient consumption deterrent in the long run.[8, 9]

[2] Most importantly, the number of people who quit smoking or do not start at all.
[3] This reduction in tobacco consumption is manifested through the set of people that discontinue smoking, and in the long run, younger individuals who do not start smoking at all.

A recurrent concern is the potential regressivity of tobacco taxes because low-income households allocate larger shares of their budget to purchase tobacco products relative to richer households. Nonetheless, in this paper we show that, if indirect (health) effects are included in the calculations, the concern about tobacco tax policies is no longer valid. Instead, the future benefits of nonsmoking outweigh the losses attributed to tobacco taxes among the population in general and among low-income groups specifically.[10, 11]

Beyond short-term reductions in household tobacco expenditures, the possible benefits of tobacco tax policies include lower medical expenditures and more healthy life years, both of which could translate into accountable economic benefits that more than offset the losses generated by tax increases when consumers discontinue -or never start- smoking. To test these hypotheses, a social welfare framework is used to calculate the effects on various income groups and different price elasticities for tobacco consumption are estimated. To establish a contextual background, section 2 briefly reviews the literature on the health effects of tobacco, tobacco policies, and price elasticities. Section 3 describes the methodology, parameters, and data used to forecast the impact of the tobacco tax. Section 4 presents the estimation results, and section 5 concludes with a discussion on policy implications.

2. The literature

a. Tobacco and health

During the last century, about 100 million deaths were related to tobacco use.[13] If current trends were to remain constant, about 1 billion people could die from tobacco-related diseases during this century.[14] In Ukraine, 7.2 million adults consume tobacco every day, and, in 2010, over 85,000 deaths were attributed to tobacco consumption.[4][15]

According to the U.S. Department of Health and Human Services, tobacco consumption is responsible or contributes to many types of cancers, including lung, oral, laryngeal, pancreatic, kidney, cervical, and acute myeloid leukemia.[3] Smoking is related to respiratory problems such as chronic respiratory symptoms, tuberculosis, influenza, pneumonia, other infections, chronic bronchitis, emphysema, and asthma. It is also associated with cardiovascular diseases, such as aneurysms, stroke, and coronary heart disease, as well as adverse reproductive and developmental effects, such as low birthweight, congenital malformation in babies, and complications in pregnancy, along with male sexual dysfunction.[3, 14] The exposure to secondhand smoke has a causal relationship with many respiratory diseases in children and adults. There are more than 4,000 chemicals in tobacco smoke (of which at least 250 are harmful and more than 50 can cause cancer). Although the nature of the causal relationship between secondhand smoke and cancer or its impact on reproduction is not clear, research has strongly connected them.[3,16] Moreover, according to the WHO, secondhand smoke is responsible for over 600,000 premature deaths worldwide.

b. Tobacco control policies

Globally, antitobacco policies include smoking prohibition in specific locations and completely smoke-free environments, advertising to deter tobacco use, smoking cessation programs, prohibitions on tobacco sales close to schools, and taxation. These various policies have shown diverse effects in tobacco use, tobacco availability and secondhand smoke exposure among the population.

[4] Children refers to individuals under 18 years of age.

WHO argues that entirely smoke-free environments, rather than separate smoking rooms or good ventilation systems, are the only way to prevent the harmful consequences of secondhand tobacco smoke.[5] Smoke-free laws are popular because there is evidence that they improve health outcomes without affecting business. In 2016, these laws benefited 19 percent of the world's population.[7] The benefits depended on the breadth of the legislation. For example, prohibiting smoking in all indoor workplaces reduced the exposure to secondhand smoke by 80 percent–90 percent and decreased the incidence of acute respiratory illness (IARC 2009).

In 2016, about 33 percent of the world's population had access to smoking cessation support programs, 21 percent more than in 2012.[7] These programs represent the fifth most widespread policy in the world.[5] They significantly raise quitting rates among smokers who want to quit and are more cost-effective compared with other health care programs.[17] Although they are effective, they only treat those addicted individuals who want to be treated. Their presence is also associated with country income, and they are mainly found in high-income countries.

Another way to discourage tobacco consumption is through health warning labels on tobacco packages. This is the third most common policy against cigarettes in the world. In 2016, almost 45 percent of the world's population was being exposed to such labeling. Warning labels are widely supported by the public and may not represent a cost to governments.[5] However, they have to be regularly updated and changed to remain impactful. The use of warnings may influence people against tobacco consumption; however, their use only accounts for a marginal decrease.[18–20]

Mass media campaigns that reach large populations represent the most popular and common way to combat tobacco use. In 2016, such campaigns addressed 56 percent of the world's population. People in low-income countries are less likely to be exposed to these campaigns. However, there is limited information about the cost-effectiveness of this approach.[5] Durkin, Brennan, and Wakefield (2012) conclude that mass media awareness programs could promote quitting; however, their impact depends on the duration of the campaigns, especially among low-income smokers. It also depends on the message; information about the adverse health risks of smoking represents the most efficient means to reach users.[21]

In Ukraine, several tobacco control policies have been adopted in the last years. In 2005, the Law on Measures to Prevent and Reduce the Use of Tobacco Products and their Harmful Impact on the Health of the Population was adopted. On 15 March 2006, Parliament ratified the WHO Framework Convention on Tobacco Control (FCTC), implemented fully on September 4, 2006.[22]

According to the WHO Reports on the global tobacco epidemic, between the Second (survey data collected in 2006 or earlier) and the Third Reports (survey data collected in 2009 or earlier), Ukraine has demonstrated one of the fastest declines in smoking prevalence in the world: age and sex standardized current tobacco smoking prevalence declined from 45% to 32%. Per the national reports, daily smoking prevalence in Ukraine decreased from 37.2% in 2005 to 25.5% in 2010. Ukraine has followed best international tobacco control practices, but the success has been achieved without governmental funding for tobacco control activities. Ukraine has almost not used those strategies which require even moderate national resources like quit lines or other cessation services. The decline in smoking prevalence hence potentially resulted from the tobacco control legislation first adopted in 2005 and amended later, which included extension of smoke free policies; step-by-step tobacco advertising bans; large health warnings and other measures; however, most of these policies were implemented between 2005 and 2007.[23]

Those legislative measures which came into force in late 2012 including (1) tobacco advertising ban — on September 16, 2012, (2) introduction of large (50% of the pack surface area) graphic health warning on tobacco packaging — on October 4, 2012, (3) smoke-free policies in restaurants and other public and workplaces — on December 16, 2012, have resulted in significant decrease of cigarette sales in Ukraine in 2013.[24]

c. Tobacco taxes

Prohibiting certain practices (e.g., tobacco marketing or indoor smoking) has a limited effect because after such practices are prohibited, they cannot be prohibited further. Increases in tobacco excise taxes are not subject to such constraints; excise taxes can continue to be increased, even if the tax rate is already very high.[25] Tobacco taxation is considered one of the most efficient measures to reduce tobacco consumption; as a secondary benefit, they also increase government revenue.[5][8] Because both effects are desirable from a policy standpoint, the use of taxes is considered to be economically justified. Additionally, the higher price elasticity of young people makes taxes a good way to fight tobacco use because taxes will significantly reduce consumption in the long run.

Institutions such as the Inter-American Development Bank (IADB 2010), WHO (2008), the International Agency for Cancer Research (IARC 2011), and the World Bank (1999) and authors such as Levy et al. (2014) have associated price increases with significant declines in tobacco consumption.[8,26–29] These authors, as well as the WHO, estimate that higher taxes are responsible for almost half the decline in smoking.[30] However, the effects of these policies mainly depend on the type of taxes. For example, ad valorem taxes are based on prices; so, tobacco companies can potentially avoid higher taxes by cutting on providers and setting lower prices. For this reason, consumption levels and tax revenue depend on the industry pricing strategy. Alternatively, specific excise taxes establish a fixed tax amount, although the tax amount must be adjusted periodically for inflation to accomplish their mission and are associated with the risk of encouraging contraband sales.[5] The taxation system in Ukraine, as in other countries, uses both types of tobacco taxes, that is, specific and ad valorem excise.

d. The price elasticity of tobacco consumption

The extent of price elasticity is crucial in calibrating the effect of taxation systems because it determines the sensitivity of demand to a change in tobacco prices. In general, tax increases generate larger shifts of tobacco purchase and consumption among low- and middle-income populations than in high-income groups (WHO 2015a). [5]

There is an extensive literature estimating the relationship between tobacco prices and consumption. Guindon (2013) provides a broad review of 26 international studies; a few should be mentioned directly.[31] Chaloupka and Grossman (1981) and Lewit and Coate (1981) estimate the elasticity among the under-18 population in the United States at, respectively, −1.44 and −1.31.[33, 34] Among adults ages 18 years or older, Chaloupka (1991) and Lewit and Coate (1981) estimate the elasticity in the United States at between −0.27 and −0.42, respectively.[34, 35] For all 52 countries in the European region, Gallus et al. (2006) estimate a price elasticity of −0.46 using national yearly aggregated data.[35] For Hungary, the price elasticity is estimated at between −0.44 and −0.37 and, for the United Kingdom, at −0.5.[37, 38] For Poland and Turkey, tobacco price elasticities

[5] Tobacco tax increases have also been associated with a rise in contraband and illegal tobacco sales, reducing the expected increase in government revenue (Jha and Chaloupka 2000) [56]

have been estimated at, respectively, −0.4 and −0.19 in the short run (−0.7 for long-run elasticity in Poland).[39, 40] For India, cigarette price elasticities have been estimated for different income groups, finding −0.83 and −0.26 for the lowest and highest income groups, respectively.[40] For South Africa, Van Walbeek (2002) estimates prices elasticities for different income quintiles, controlling for income changes, and finds elasticities of −1.39 and −0.81 for the poorest and richest income quintile, respectively.[41] For Taiwan, China, price elasticities of tobacco have been estimated at −0.29.[42]

Research conducted in such countries as USA, UK, Canada, Bangladesh, China, and Indonesia has indicated that smoking prevalence among men and women in lower socioeconomic groups is more responsive to the changes in cigarette prices; however, in countries such as the Arab Republic of Egypt, Bulgaria, and Turkey the evidence is mixed [IARC 2011]. In Ukraine, we see little difference in response to sharp price increase among different SES groups in short-term perspective, while in medium-term perspective (5 years) tobacco tax hikes have higher impact on smoking prevalence rates among the younger and poorer.[23]

There are two important factors involved in determining tobacco price elasticities: income and age. People in low-income groups have more elastic demands relative to medium- and higher-income groups.[14] At the same time, younger groups in populations are more responsive to price and thus tax increases because they tend to be less nicotine dependent, more affected by peer effects, and possess less disposable income.[14] Studies in the United States have consistently shown that younger groups have higher elasticities relative to older groups.[32,33,43]

e. Further costs of tobacco: Life, work, and medical expenses

The major costs of tobacco consumption beyond the direct price are associated with public and private health care costs. Tobacco-related health care costs can be either direct or indirect. Direct costs include the monetary value of the consumption of goods and services motivated and, in many cases, compelled because of tobacco use. These are divided into health care costs (hospitalization, medication, medical supplies, equipment, and so on) and non–health care costs (job replacements for sick smokers, insurance, cleaning up the cigarette ash and stubs, packaging, and smoke residue of smokers, and so on). Goodchild et al. (2016) estimate that the global economic cost of tobacco-related diseases is equivalent to 1.8 percent of the world's gross domestic product (GDP).[57] For the United States, the direct health care costs associated with tobacco-related diseases are estimated at 1.1 percent of GDP or 8.7 percent of annual health care spending.[6][44] Meanwhile, the indirect costs include the loss of productivity because of lost working days related to smoking illnesses and the value of the lives prematurely lost. Both effects are incorporated in the disability-adjusted life years indicator.[45]

Focusing on health care costs, Lightwood et al. (2000) estimate the cost of tobacco use. They suggest that the gross health care cost in high-income countries fluctuates between 0.1 percent and 1.0 percent of GDP.[46] In terms of price elasticities, limited data inhibit accurate estimates in low- and middle-countries, but the authors argue that the price elasticity could be as high as those in high-income countries. Meanwhile, Verguet et al. (2015) analyze the health effects of a price increase in China.[12] Their research concludes that a 50 percent rise in prices would result in 231 million years of life gained over 50 years, with a significant impact in the lowest income quintile. Pichón-Riviere et al. (2014) estimate that tobacco use in Chile will reduce life expectancy by

[6] Estimated cost US$169.3 billion divided by GDP (2010); US$14.96 trillion equals 1.13 percent.

nearly 4.0 years among women and 4.3 years among men.[47] There would also be about 379,000 life days lost, which is more than a thousand years.[7]

The research represented in this paper takes advantage of the current literature on health care costs. It draws information and ideas from Marquez et al. (2017) and others who estimate the long-term health care costs of tobacco in Ukraine and adds new estimates and measures of the incidence of disease and of income distribution.[54] From a methodological standpoint, this paper follows the methods described by Fuchs and Meneses (2017).[48]

f. Costs and benefits that are not included

Some well-researched costs and benefits are not covered in this paper. Secondhand smoke has been shown to be an important societal cost of smoking, affecting the health of adults and children.[49] In one example, from the state of Indiana, the health-related costs of secondhand smoke have been estimated at more than US$1.3 billion yearly, US$201 per-capita. However, this paper does not include the cost of secondhand smoke in the analysis because of the lack of detailed information required about smoking within households or the workplace.

As discussed earlier, one potential channel in which tobacco taxes can improve income inequality is the possible use of tax revenues on progressive policies such as direct income transfers or services. These policies might involve expansions in health care, social welfare, and education expenditures. Although earmarking tax revenues for specific projects -such as health care, social welfare or education- is a common practice in some countries, this paper does not include them in the assessment as they depend on a myriad of factors that include political decisions. Therefore, this paper covers only benefits that directly arise from tobacco tax policy.

3. Model

The impact of the tobacco tax in Ukraine is estimated using a social welfare framework similar to the framework applied elsewhere in the literature.[12,50] The potential changes in household welfare induced by an increase in tobacco taxes is estimated by considering three factors: (1) the rise in tobacco expenditures because of the tax increase, (2) the reduction in medical expenses because of lower tobacco consumption, and (3) the change in incomes because of reduced mortality, leading to additional work years.[8] The aggregated effect of the tax policy is estimated as follows:

Income effect = change in tobacco expenditure (A) + lower medical expenses (B) + rise in income (C) (1)

The basis of the analysis rests on the Ukrainian Household Living Conditions Survey 2012. The survey is designed to measure general patterns of expenditure, including expenditure in tobacco products. Data limitations do not permit a simulation of the exact price increases by brand, but this may be accomplished using the aggregate prices paid by households.

A partial equilibrium model allows the distributional effects of the tobacco tax to be assessed, resulting in an estimation of the first-order effects of these policies. A partial equilibrium approach is then used, and the change in prices is evaluated, mainly by relying on household expenditure patterns. This decision implies that only the

[7] Days lost refer to years of life lost (YLL) because of premature mortality. Another indicator is years lost because of disability (YLD) among people living with poor health and its consequences. Usually disability-adjusted life years = YLL + YLD.

[8] Other studies have also evaluated productivity loss, disability costs, externalities, and so on. Because of the availability of relevant data, this paper focuses solely on medical expenses and income changes associated with shifts in mortality.

first-order response is assessed and that additional behavioral changes among economic agents are not covered, such as the expansion in the consumption of other goods. These assumptions imply that the model uses the share of tobacco consumption in household budgets per price increases. The loss in real income arising from price increases in products i = 1, …, n is obtained by

$$\sum_{i}^{n}(\omega_i + \Delta\omega_i) * \frac{\Delta p_i}{p_{i,o}}, \qquad (2)$$

where ω_i is the share of product *i* in total household expenditure, and Δp_i is the percent price increase.[9] Therefore, if 10 percent of the total budget is destined for cigarettes, for example, and the price of cigarettes rises by 10 percent, the real loss in income amounts to 1 percent. $\Delta\omega_i$ is the change in consumption of the taxed good, which depends on the price elasticity of the specific good.

Tobacco expenditures: The variation in tobacco consumption after the tax increase is estimated based on a consideration of the change in prices (ΔP), the tobacco price elasticity ε, and the tobacco expenditure of decile *i* in period 0 ($Expenditure_{i0}$).

$$\Delta\, Tobacco\ Expenditure_i = ((1 + \Delta P)(1 + \varepsilon * \Delta P) - 1) * Expenditure_{i0}{}^{10} \qquad (3)$$

The change in tobacco expenditure is divided by the total expenditure for each decile group *i*, thereby obtaining a comparable per household measure of the change in tobacco expenditure relative to the total expenditure of each decile group, as follows:

$$\Delta\, Prop.Tobacco\ Expenditure\ = \frac{((1+\Delta P)(1+\varepsilon*\Delta P)-1)*Expenditure_{i0}}{Total\ Expenditure_i} \qquad (4)$$

This gives us the change in the proportion of tobacco expenditure, that is the change in tobacco consumption in relation to the household budget.

Medical expenses: The change in medical expenses from tobacco-related diseases is estimated in equation (5), obtaining the cost of the treatment of tobacco-related diseases for income decile *i* from Pichón-Riviere et al. (2014) and adjusts it according to the expenditure survey.

$$\Delta\, Prop.Medical\ Exp. = \frac{((1+\varepsilon*\Delta P)-1)*Cost\ Treat.Tobacco\ Related\ Diseases_i}{Total\ Expenditure_i} \qquad (5)$$

Equation 5 shows the income gains associated with the reduction in medical expenses because of lower tobacco consumption in the long term. Although the calculation is not realistic in the short term because it assumes that the effects of tobacco-related disease will immediately diminish with the reduction in tobacco consumption, while, in practice, this outcome would require a few years.[11]

Increase in the length of working life: The impact on incomes from the rise in the number of years of employment is then estimated. In the baseline, the income lost because of disability or death associated with tobacco consumption is estimated (equation 6).[12] The years lost are distributed across each decile proportionately to the

[9] For a detailed discussion of the methodology, see Coady et al. (2006) and Kpodar (2006).[51,52]

[10] Another expression might be $\Delta\ \mathrm{Expenditure} = \Delta C \Delta P + \Delta C P_0 + \Delta P C_0$.

[11] Other studies have forecast the pass-through between the decline in tobacco consumption and the effect on medical expenditures. These estimates may also differentiate the effect associated with people who stop consuming tobacco versus people who do not start because of the tax policies. Because of data restrictions, these assumptions cannot be used in this paper.

[12] Income is assumed to be equal to the average consumption of each household per decile.

number of households that consume tobacco, and the income lost is estimated as the average income per household. The effect of the tax increase is then estimated in relation to the income gains because of increased years of employment. It is expected that incomes will fall as the number of years lost increase because of higher numbers of premature deaths from tobacco consumption.

$$\Delta \text{ Proportional } Income = \frac{((1+\varepsilon*\Delta P)-1)*Years\ lost\ Per\ Decile*IncomeLoss_i}{Total\ Expenditure_i} \quad (6)$$

Lastly, total welfare gains are estimated for each income group by adding the results of the reduction of medical treatments, the gains in working years, and the increase in tobacco expenditures (see equation 1).

a. Elasticity parameters

After the model is defined for the calculation of the impact on income of the tobacco taxes, the estimates in the literature on elasticities, disease prevalence, the cost of medical treatments, and mortality patterns are examined. Several studies have estimated the tobacco price elasticity in Ukraine and other European countries. Within this research, the work of Denisova and Kuznetsova (2014) and Krasovsky et al. (2002) stands out for their use of prices and quantities of tobacco in Ukraine. The parameters estimated by Krasovsky et al. (2002) are an average price elasticity of −0.24, with variations by income group and age. Denisova and Kuznetsova (2014) generate lower and upper bounds for this elasticity to simulate the impact of tobacco price rises.

Table 1 shows the elasticities estimated by Denisova and Kuznetsova (2014). Their elasticities are divided into 10 income deciles. The average elasticity is similar to Verguet et al. (2015) and to estimates on other countries.

Table 1. Tobacco Price Elasticities, by Income Decile: Denisova and Kuznetsova (2014) (%)

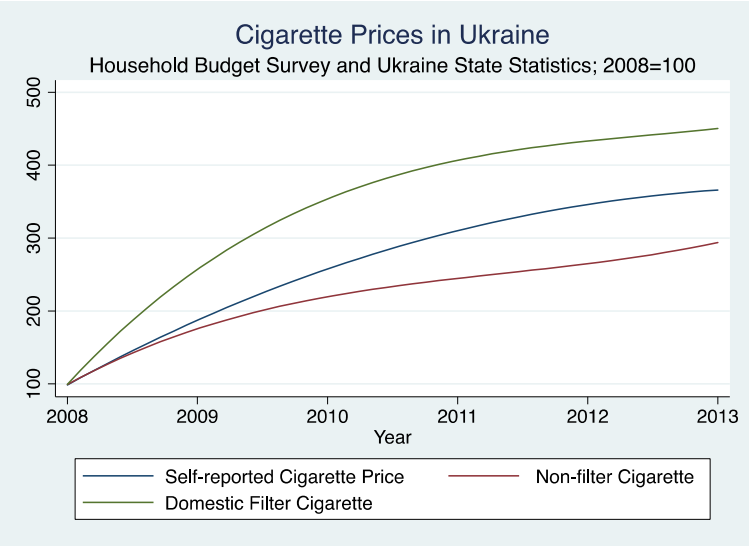
Price elasticity	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*	*Average*
Lower bound	−36	−34	−32	−27	−22	−15	−14	−10	−7	−3	−20.0
Medium bound	−44	−42	−40	−35	−30	−23	−22	−18	−15	−11	−28.0
Upper bound	−56	−54	−52	−47	−42	−35	−34	−30	−27	−23	−40.0

Sources: Denisova and Kuznetsova 2014;

b. Elasticity calculations

To enhance the analysis, tobacco price elasticities are estimated using the household budget survey, 2010–13. The declared prices paid by households and the quantities of cigarettes purchased are used; this allows the calculation of a measure of effective price per cigarette, considering brand pricing variability. Figure 1 shows the variation in the price of cigarettes estimated using the household survey and the changes in prices using national statistical data on Ukraine. As expected, the variation in the prices paid by households reflect price variations between filtered and nonfiltered cigarettes, showing that households adjust consumption budgets as prices change.

Figure 1. Tobacco Price Variation, 2008–13



Once a measure of the price of cigarettes in Ukraine is obtained, the tobacco price elasticity across population groups is estimated (refer to Appendix I for more details). Table 2 shows the tobacco price elasticity across income deciles and other subgroups in the population: total population, household heads ages 25–40, and household location (rural versus urban).

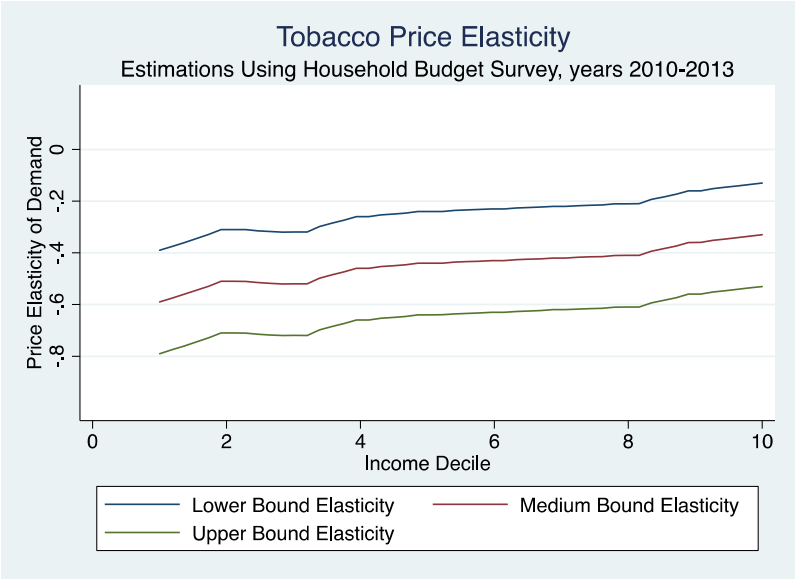
Table 2 - Tobacco Price Elasticities, by Income Decile, Age, and Location (%)

Price elasticity	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*	*Average*
Total population	−59	−51	−52	−46	−44	−43	−42	−41	−36	−33	−45
Under age 40	−77	−69	−73	−70	−61	−64	−56	−64	−51	−51	−64
Rural	−47	−30	−32	−30	−27	−27	−33	−26	−22	−21	−29
Urban	−62	−65	−63	−55	−53	−52	−48	−50	−45	−41	−53

Source: Estimates based on data of the household budget survey, 2010–13.

Estimates of the average tobacco price elasticity of −0.45 are higher than those calculated by Krasovsky et al. (2002) for Ukraine (-.25). To incorporate different assumptions of price elasticities, lower-bound and upper-bound elasticities are simulated. These estimates show differences between −0.2 and +0.2 relative to the previously estimated elasticities. The lower-bound elasticities are similar to Krasovsky et al. (2002) and tend to reflect income groups that typically do not change patterns of consumption, such as rural residents or older population groups. These groups tend to exhibit less change in consumption when prices change.

Figure 2. Tobacco Price Elasticities, Lower, Medium, and Upper Bounds (%)



The upper-bound elasticity tends to reflect a longer-term scenario, echoing the effect the tobacco tax would have on younger smokers (table 3). After a few decades, these people will represent the majority of the population as older smokers die or quit smoking. The total average effect of the price increase over the long term would therefore be approximated more closely by the upper-bound price elasticity.

Table 3. Tobacco Price Elasticities, by Income Decile: Fuchs and Meneses (2017) (%)

Price elasticity	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*	*Average*
Lower bound	−39	−31	−32	−26	−24	−23	−22	−21	−16	−13	−25
Medium bound	−59	−51	−52	−46	−44	−43	−42	−41	−36	−33	−45
Upper bound	−79	−71	−72	−66	−64	−63	−62	−61	−56	−53	−65

Source: Estimates based on data of the household budget survey, 2010–13

Once changes in tobacco expenditure due to price increases are calculated, we proceed to calculate the incidence of tobacco consumption on medical treatments, lost years of work, and related costs. Denisova and Kuznetsova (2014) estimate the incidence of tobacco on medical spending. As a secondary source of information, the Ukrainian government and WHO have estimated the disease prevalence in each age-group and the monetary cost of treatment. This information allows a calculation of the average cost of medical treatment for each disease. The cost of lost years of employment can be estimated using the household consumption survey (see below).

c. Mortality age patterns

Early mortality related to tobacco consumption is analyzed to obtain the elasticities. Medical events associated with tobacco show a strong relationship with age and the number of years of smoking. Table 4 illustrates age patterns in tobacco-related deaths. Lost years of life are distributed among households using the proportion of households that have smokers, and the income (or wages) of this population segment is used to estimate the working years lost.

Table 4. Tobacco-Related Deaths

Age-group	*Ischemic disease*	*Stroke*	*Other cardiovascular diseases*	*COPD*	*Other respiratory diseases*	*Lung cancer*	*Other cancers*	*Other causes*
0−1	-	23	50	-	49	-	143	4,299
1−4	-	1	13	-	112	-	62	739
5−14	-	8	20	-	171	4	25	851
15−24	128	66	182	14	438	9	138	4,930
25−34	718	288	964	43	1,251	54	704	13,528
35−54	13,472	5,585	7,056	2,244	13,989	691	2,757	42,064
55−74	118,364	37,654	12,794	9,586	43,274	5,553	2,132	33,808
75+	181,987	57,724	27,992	2,289	15,306	6,441	767	24,653
Total	314,669	101,349	49,071	14,176	74,590	12,752	6,728	124,872

Source: Calculations using data of Denisova and Kuznetsova 2014.
Note: COPD = chronic obstructive pulmonary disease.

d. Cost of treatment

To estimate the medical costs of tobacco consumption, tobacco-related medical treatments and deaths are examined. The Ukrainian Department of Health Statistics and Information provides information on mortality related to tobacco consumption for 2013. As a second source of information, the total number of tobacco-related events are also obtained from Denisova and Kuznetsova (2014) (see table 4).[13]

Once the estimates of the number of deaths and the incidence of other events have been calculated, we investigate the medical treatment costs for each of these diseases. Table 5 shows estimates of the average cost of medical treatment for tobacco-related diseases in Ukraine. These expenses refer to the cost of treatment incurred by the state and exclude the costs to users. Although Ukraine has an extensive public health care system, not all medical costs are covered by the state. According to the National Health Accounts of Ukraine in 2015, out-of-pocket expenses accounted for 40.5 percent of all medical costs in Ukraine. This cost is covered directly by user expenditures. These costs usually consist of the inputs, medicines, and pharmaceutical components of the treatment. The estimate of the cost of treatment of these diseases therefore includes out-of-pocket expenditures calculated at 40.5 percent of the total expenditure.

Table 5. Cost of Medical Treatments Per Case

Disease	*Tobacco-related morbidity, men, %*	*Tobacco-related morbidity women, %*	*Governmental cost, US$*	*Out-of-pocket cost, US$*
Ischemic heart disease	24	2	584	389
Stroke	25	2	684	456
Other cardiovascular diseases	25	2	438	292
Respiratory diseases (COPD)	56	17	244	163
Lung cancer	91	27	633	422
Other cancers	44	3	633	422

Sources: Calculations using data of Denisova and Kuznetsova 2014. For tuberculosis WHO 2004; Vasalal et al. 2008.[53]
Note: US$1.00 = Hrv 8 for years 2013. COPD = chronic obstructive pulmonary disease

Table 6 shows the annual medical costs of tobacco-related mortality. The results are taken from calculations based on the data in tables 4 and 5. After calculating the costs related to diseases, the cost of the treatment of illnesses that are related to tobacco consumption are calculated (table 7). Cardiovascular diseases, cardiovascular

[13] Although determining the exact cause of each particular disease is not possible, the medical community has agreed on the probabilities of disease occurrence by age, gender, and tobacco consumption. The resulting tables of probabilities, along with tobacco incidence, are used to estimate the deaths related to tobacco.

surgeries, other respiratory diseases (pneumonia and bronchitis), other cancers, and tuberculosis are included as major causes of the costs associated with medical care. Data on these costs have been collected based on various academic, national, and international sources.

Table 6. Total Medical Cost of Tobacco-Related Cases

Cost item	*Ischemic disease*	*Stroke*	*Other cardiovascular diseases*	*COPD*	*Other respiratory*	*Lung cancer*	*Other cancers*	*Total*
Goverment cost (US$)	584	684	438	244	244	633	633	
Out-of-pocket cost (US$)	389	456	292	163	163	422	422	
Tobacco attributed								
Men, %	24	25	25	56	29	91	44	
Women, %	2	2	2	17	3	27	3	
Cases, men	32,720	10,069	5,476	6,643	10,766	7,902	2,207	75,782
Cases women	3,567	1,222	543	393	1,124	1,099	51	7,999
Total tobacco-attributed cases	36,286	11,290	6,019	7,036	11,890	9,000	2,259	83,781
Total government cost (US$)	21,191,269.28	7,722,360.00	2,636,370.18	1,716,808.40	2,901,145.36	5,697,101.28	1,429,826.73	43,294,881
Total out-of-pocket cost (US$)	4,127,512.85	5,148,240.00	1,757,580.12	1,144,538.93	1,934,096.91	3,798,067.52	953,217.82	28,863,254

Note: COPD = chronic obstructive pulmonary disease.

Table 7. Medical Costs of New Tobacco-Related Cases

Indicator	*Cardiovascular diseases*	*Cardiovascular surgeries*	*Other respiratory*[a]	*Other cancers*[b]	*Tubercolosis*	*Total*
Goverment cost (US$)	90	834	91	633	398	
Out-of-pocket cost (US$)	60	556	61	422	265	
Total cases	2,245,864	10,085	312,424	147,074	30,819	
Tobacco attributed, %	29	29	25	26	9	
Tobacco attributed cases	651,301	2,925	78,106	38,239	2,774	
Total goverment cost (US$)	58,617,050	2,439,041	7,107,646	24,205,439	1,103,382	93,472,558
Total out-of-pocket cost (US$)	39,078,034	1,626,027	4,738,431	16,136,959	735,588	62,315,039

Sources: Cardiovascular surgeries, number of procedures: Sokolov et al. Register of percutaneous coronary interventions: a comparative analysis, reperfusion therapy in Ukraine, Survey PKV 2015. Journal Heart and vessels, 2015, issue 3: pages 7–29. Calculation of the average price of one stent was based on public information on the Ministry of Health website on the number of stents in 2017 and the total budget for this purpose (http://moz.gov.ua/ua/portal/pre_20170809_a.html). The market cost of the supplies kit for coronary angiography was taken from the price-list of private clinics, "Clinics of New Technologies," based at the National Institute of Cardiovascular Surgery, M. M. Amosov, Academy of Medical Sciences of Ukraine, http://www.cnt-amosov.com.ua/index.ukr.php. Costs are taken from "Where the money goes and how to get more with scarce resources in the Ukraine's health care: Report on findings of PETS/QSDS survey," joint report of the World Bank, United Nations Development Program, and Kyiv School of Economics, 2017. Tuberculosis data taken from Vassall et al. 2008.

a. Pneumonia and bronchitis.

b. All other cancers, but lung cancer.

The total estimated out-of-pocket cost of tobacco is over US$90 million, similar to the estimates of the government costs calculated by Denisova and Kuznetsova (2014).

e. Summary of descriptive statistics

Table 8 summarizes the most important indicators, including total monthly expenditure from the household consumption survey and the incidence of household tobacco purchases. The cost of the medical treatment of tobacco-related diseases is estimated as a proportion of monthly income for each income decile. The share of income lost because of years of employment lost resulting from tobacco-related mortality is then estimated.

Table 8. Baseline Descriptive Results, Household Survey 2013

Indicator	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Household expenditure (US$)	311	398	431	458	518	523	576	620	685	1282
Proportion tobacco[a]	2.5	2.5	2.4	2.2	2.2	2.2	2.1	1.9	1.8	1.5
Households that smoke (%)	40	44	42	41	41	39	42	43	38	41
Woman-headed households (%)	55	52	51	56	54	57	58	57	54	57
Age, household head	51	50	51	53	52	53	54	54	53	51
Percentage HH with a Child 3–6 years of age	28	26	20	16	15	10	11	8	7	4

a. Proportional to total budget per household in each decile

4. Results

The three scenarios in the tobacco price elasticity, lower bound, medium bound, and upper bound, are presented in table 3. These three scenarios allow an understanding of the ways results could change under different assumptions.

a. Tobacco price increase

As a first step, the income changes for each income decile arising from the increase in tobacco prices are estimated based on low-, medium-, and upper-bound elasticity. Using equation (4) and tables 3 and 8, one can calculate the effects of the tobacco price increase. For example, given the lower-bound elasticity (−0.39) in table 3, the proportion of tobacco expenditure among the first decile (2.5 percent) in table 8, and a price increase of 25 percent, there was increased expenditure of 0.32 percent. This represents a loss in welfare among consumers because they have to devote a higher proportion of their incomes to purchase the same amount of tobacco and reduce their consumption of other goods. The results for all income deciles and elasticity scenarios are shown in table 9.

Table 9. Direct Effects of the Price Increase Because of Taxes (%)

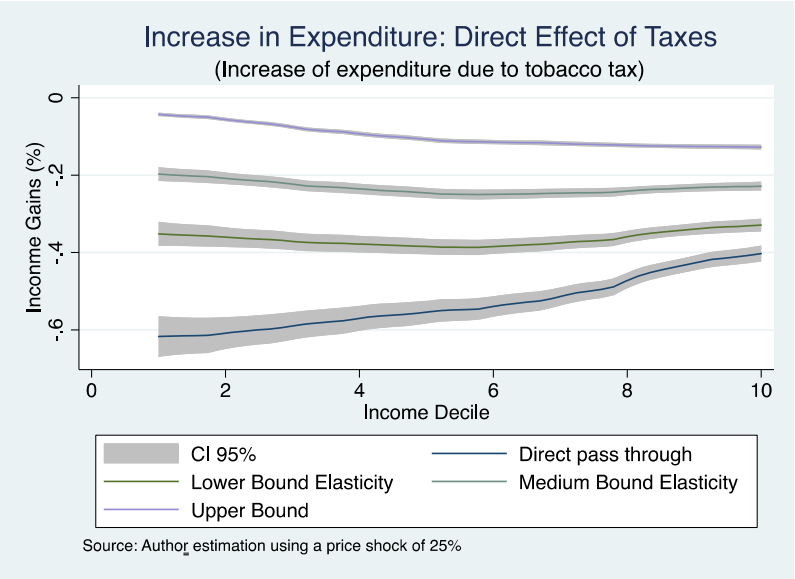
Price shock scenario	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Complete pass-through	0.62	0.62	0.60	0.56	0.56	0.55	0.53	0.48	0.45	0.37
Low-bound elasticity	0.32	0.38	0.36	0.38	0.39	0.39	0.39	0.35	0.36	0.31
Medium elasticity	0.16	0.22	0.21	0.24	0.25	0.25	0.25	0.23	0.25	0.22
Upper-bound elasticity	0.01	0.07	0.06	0.10	0.11	0.12	0.12	0.11	0.14	0.13

Source: Proportion of household budget. Based on data of the 2013 household budget survey.

Note: The table shows the share of total household budget for each decile. Complete pass-through refers to elasticity equal to zero; consumers pay all the increased prices.

Across the three elasticities, the direct effect of the tobacco tax is a welfare loss, but in none of the cases does the shock seem to be regressive. In the low-, medium-, and upper-bound elasticity scenarios, the effect of the price increase is progressive, affecting higher-income groups in a higher proportion (figure 3). To show the effect of the elasticities on prices, table 9 includes the estimates of a complete pass-through scenario, whereby the increase in prices is completely passed to consumers without a reduction in consumption. Only in this case is the price shock regressive, affecting the lower-income deciles to a greater degree.

Figure 3. Direct Expenditure Effect: Direct Effect of Tobacco Taxes



b. Medical expenses

The yearly medical costs associated with tobacco consumption are estimated, assuming a direct medical impact on health. Although this assumption is unrealistic in the short run, the long-run reduction of tobacco consumption would tend to behave according to this pattern, whereby a reduction in tobacco consumption would be strongly related to a reduction in tobacco-related diseases and thus a reduction in medical costs (table 10). Health care expenditures are estimated using equation (5) and tables 3 and 8.

Table 10 – Reduction in Medical Costs (%)

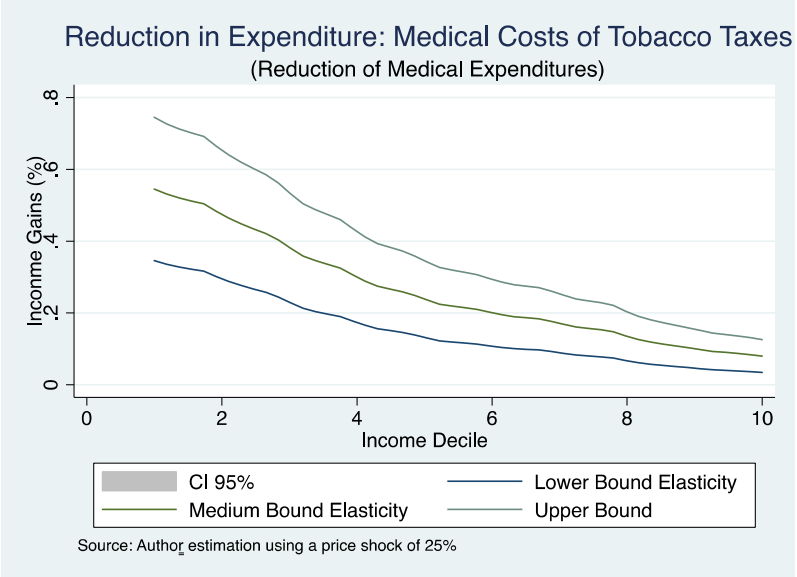
Price shock scenario	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Lower-bound elasticity	0.43	0.30	0.24	0.16	0.13	0.10	0.09	0.08	0.04	0.02
Medium elasticity	0.64	0.50	0.40	0.28	0.24	0.19	0.18	0.16	0.10	0.06
Upper-bound elasticity	0.86	0.70	0.55	0.41	0.35	0.28	0.26	0.24	0.16	0.10

Source: Proportion of household budget. Based on data of the 2013 household budget survey.

Note: The table shows the share of total household budget for each decile.

The reduction in tobacco consumption would have a positive effect on income through reduced medical treatments. The saving in expenditure would vary between 0.43 and 0.02 percentage points of the household income in the case of the lower-bound elasticity assumption, between 0.64 and 0.06 percentage points in the case of the medium-bound elasticity, and between 0.86 and 0.1 percentage points in the case of the upper-bound elasticity (figure 4). These results show the importance of the elasticity assumptions; they also stress the relevance of the possible elasticity variations across income groups.

Figure 4. Reduction in Expenditure: Because of the Reduction in Medical Expenditures



c. Income gains because of increased years of employment

The cost of working life lost because of tobacco consumption is estimated based on the assumption that there is a direct impact of lower tobacco use on health and thus work-generated income. The impact on the income of each income decile is calculated using the age pattern of mortality and estimating the years of life lost. The welfare effect is then estimated using the lower-, medium-, and upper-bound elasticity by decile variation.

The 218,658 deaths attributed to tobacco consumption are distributed using the occurrence of mortality profile.[14] For each death, the number of potential years of work are calculated, and the lost working years are divided across the deciles according to tobacco consumption. Using equation (6) and tables 3 and 8, one may calculate the impact of the tax increase on the increase in the years of employment. For example, in the first decile, assuming the upper-bound elasticity, the income increase would be 0.01 percent of income. Table 11 shows the results for all deciles using the three elasticity scenarios.

Table 11. Years of Working Life Lost and Income Increase (%)

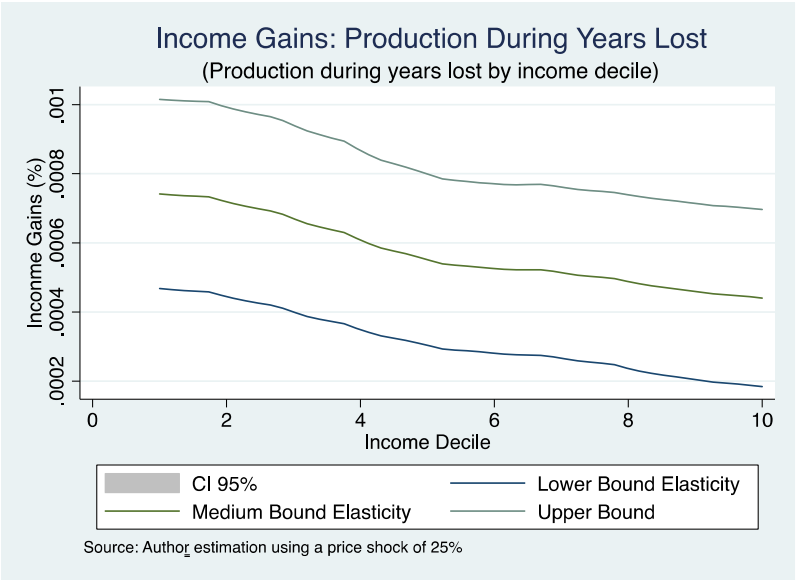
Price shock scenario	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Low-bound elasticity	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
Medium elasticity	0.0008	0.0007	0.0007	0.0006	0.0006	0.0005	0.0005	0.0005	0.0004	0.0004
Upper-bound elasticity	0.0010	0.0010	0.0010	0.0009	0.0008	0.0007	0.0008	0.0008	0.0007	0.0007

Source: Proportion of household budget. Based on data of the 2013 household budget survey.
Note: The table shows the share of total household budget for each decile.

[14] Numbers based on 2013 data.

The results show that the reduction in tobacco consumption and the expected increase in years of potential work have positive impacts on welfare. In the first scenario, the gains are evenly distributed across income deciles. However, elasticities vary across deciles, generating an important impact on lower-income groups (figure 5).

Figure 5. Income Gains, Production during Years Lost



d. Net effects: Total distributional impacts

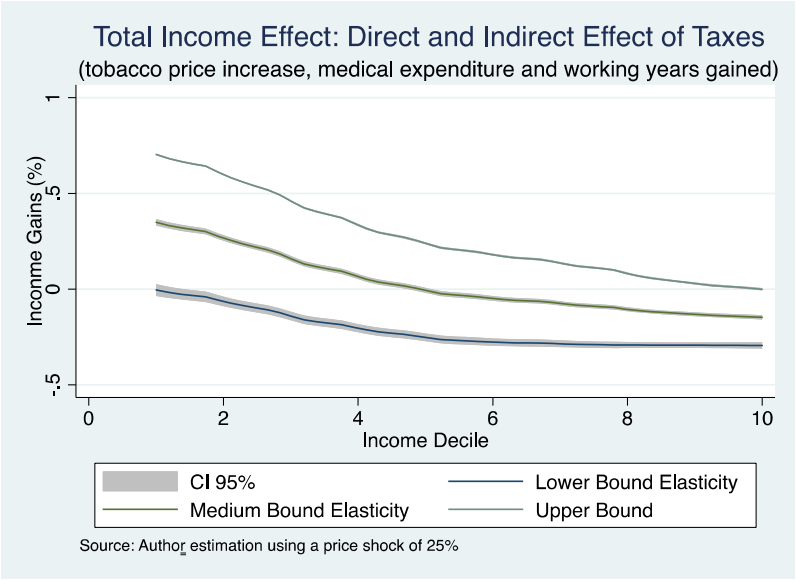
Once the effects of the tobacco tax policy on prices, medical expenditures, and increased years of employment are calculated separately, one may examine the bigger picture. Based on a lower-bound elasticity, the results show a mixed effect of tobacco tax policy. The effect is progressive in that it has a smaller impact on the lower-income groups of the population relative to the higher-income groups, but the overall effect is negative (table 12; figure 6). Apparently, a population that is not as sensitive to tobacco price changes will not reduce consumption sufficiently to allow health and work benefits to offset cost increases. This is exactly what happens in Ukraine.

Table 12. Total Net Effect (%)

Price shock scenario	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Low-bound elasticity	0.11	−0.08	−0.12	−0.22	−0.26	−0.29	−0.29	−0.27	−0.32	−0.29
Medium elasticity	0.48	0.28	0.19	0.05	−0.01	−0.06	−0.08	−0.07	−0.15	−0.16
Upper-bound elasticity	0.86	0.63	0.49	0.31	0.24	0.16	0.14	0.12	0.02	−0.02

Source: Proportion of household budget. Based on data of the 2013 household budget survey.
Note: The table shows the share of total consumption for each decile.

Figure 6. Total Direct and Indirect Expenditure Effect of Tobacco Taxes



In the case of a medium-bound elasticity, the tax has a progressive impact because of a positive effect on lower-income groups and a negative effect on higher-income groups. In the case of the upper-bound elasticity, the tax would have positive and progressive distributional effects, benefiting lower-income groups in larger proportion and having a negative effect on the highest income decile. Although this effect is driven mostly by the elasticity variance among income deciles, the elasticity level is also relevant. The tax would have a positive effect on most income groups, but also show a progressive pattern, that is, greater benefits for lower-income groups.

In conclusion, under a low tobacco price elasticity scenario, the overall effect is negative for all income groups. In the medium-bound scenario, the results are mixed, being positive among lower-income groups and negative outcomes among higher-income groups. In the case of an upper-bound elasticity scenario, there would be income gains among the first eight deciles of the population, and a progressive pattern. Moreover, the impact would be particularly important among lower-income deciles. Furthermore, the assumptions in this model do not include other possible policies, such as smoking cessation programs, antismoking advertising, youth outreach, or policies financed through the new tax revenue. Therefore, these results are in line with the literature, showing the important role that taxation plays in lowering tobacco usage.

5. Discussion

There has been extensive research on the negative effects of tobacco consumption on health and well-being, as well as the benefits of various public policy mechanisms aimed at reducing tobacco use. One of the most efficient ways to deter tobacco use is the implementation of taxes, both ad valorem and specific excise taxes. However, questions remain regarding the net positive effect of these policies and whether tobacco tax increases end up hurting poorer people more, as they happen to be more likely to smoke, to have poor health and less access to insurance and adequate treatment. The question of regressive taxation is particularly important because the welfare effects derived from increased taxes heavily depend on the price elasticity of this item across

different sectors of the population. Price elasticity will determine the magnitude of the income shock, as well as the benefits gained because of the reduction in tobacco consumption.

Much of the net welfare gain occurs through the reduction in medical costs and the increase in potential working years associated with good health, an effect of lower levels of tobacco consumption. If a tax merely raises prices without reducing purchased quantity, it would fail to be an effective policy. Thus, it is critical to understand the effects of these sorts of policies by determining the aggregate welfare gains or losses generated. A responsible and comprehensive policy analysis should focus on poorer groups because consumption taxes can be regressive and because the poor are also more likely to smoke. One of the main motivations of this paper is to weigh the main costs and benefits of tobacco taxation to determine if, in the end, the policy is regressive or not.

Results show that -when considered by itself- a price increase on tobacco through higher taxes would lead to slight tobacco expenditure increases across all population groups simply because of the higher price effect. This effect is more accentuated under the lower-bound elasticity scenario and more moderate as elasticity increases in absolute terms. Conversely, with a more comprehensive approach -including benefits through lower medical expenses and an increase in potential working years- the short-term tax burden is more than compensated. The tax increase shows a progressive pattern in all cases, though the absolute benefits vary. The reduction in medical expenses is the main driver of the increase in net incomes because of the reduction in tobacco-related problems, which require expensive treatments. In all three scenarios based on elasticity, the benefits of the reduced medical costs are greater, particularly among lower-income groups. This is because of the lower income. Assuming that medical expenses are constant across all population groups, the income increases are less among higher-income groups.

The various elasticity assumptions produce three distinct set of results. The lower-bound elasticity creates losses among most income groups, but follows a somewhat progressive pattern. The medium-bound and upper-bound elasticities lead to income gains among lower-income groups, but losses among higher-income groups. Thus, the effect of tobacco taxes on the various income groups is exacerbated if the variation in price elasticities across income deciles is greater. In all three scenarios, the taxes have a progressive effect on income distribution.

The three price elasticity scenarios mimic the short- versus the long-term effects of a tobacco tax. There is evidence that adult smokers will only present small changes in their behavior if faced with price increases; the lower-bound elasticity is likely to measure this situation. In contrast, younger people usually show more elastic demand, that is, demand that is similar to the upper-bound elasticity. After a few decades, one may expect the impact of the tax policy to resemble the upper-bound elasticity scenario, as young people replace older groups in the population.

The results provide evidence that supports possible preservation or increase in tobacco taxes. The analysis also shows the importance of tobacco price elasticity in assessing the potential effect of this type of public policy. Specifically, this paper suggests that taxation, especially in the short run when price elasticity is lower, should be accompanied by other policies to deter smoking, such as smoking cessation programs or mass media campaigns on the negative effects of tobacco use. Because the effect of and reaction to price changes differ across income groups, specific policies should be targeted at different groups, but focus on low-income households. For example, smoking cessation programs, which tend to be expensive and less accessible to those with fewer resources, could be made more accessible to lower-income groups, along with targeted advertising specifically adapted to different sociocultural contexts. Overall, an integrated policy approach that involves

coordination between taxation and behavior change may be the most effective, especially in the short term, while price elasticities are still low. Further research should focus on which combination of public policies is most (cost) effective across income and age-groups, given that price elasticities differ across the population. Future research on the new Ukrainian tobacco tax should also allow for analysis on how price elasticities change in the real world.

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Appendix I

Elasticity Estimation: To estimate the price elasticity of tobacco, per income decile. We obtain four years of household consumption surveys for a Ukraine. We use the Household Budget survey from Ukraine for the years 2012, 2013, 2014 and 2015. The methodology used is a repeated cross section analysis, and as the survey is nationally representative at the decile level, it could be used as a replacement of a panel data set, under the assumption that income deciles are comparable during each year and represent the same group of the population. These data sets have been translated and standardized by the World Bank. For all data sets we calculate and check the tobacco consumption, income level and calculate income deciles and effective price paid per quantity. The four surveys are merged into a single data set to estimate a single regression. Using official statistics, we obtain the inflation rate of the country for these years and deflate prices, to make them all comparable.

In the surveys for Ukraine we have quantity consumed and total price paid per package. Therefore, we estimate the effective price paid per package, in each purchase, in each household. We eliminate outliers that are three standard deviations from the mean, under the assumption that these purchases tend to reflect data problems. We estimate the price elasticity of demand of tobacco using the following equation:

$$\mathrm{Ln}(quantity\ tobacco)\,. = \sum_{1}^{10} \beta_i * Decile_i \text{ *Ln(price)} \qquad (7)$$

We estimate the lower and upper bounds and estimate the reductions in consumption. To estimate the lower bound we usually look for assumptions on what would could be the price elasticity of rural or population that is highly addicted to tobacco. For the upper bound, we look for the elasticity of younger groups of the population, that may reflect the longer-term scenario. In the case of Ukraine, the difference among these groups then found to be around 0.16 -0.19 in absolute values. Therefore, we use a 0.2 band for our lower bound and upper bound scenarios.

Table A1 - Tobacco Price Elasticities, by Income Decile, Age, and Location (%)

Price elasticity	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*	*Average*
Total population	−59	−51	−52	−46	−44	−43	−42	−41	−36	−33	−45
Under age 40	−77	−69	−73	−70	−61	−64	−56	−64	−51	−51	−64
Rural	−47	−30	−32	−30	−27	−27	−33	−26	−22	−21	−29
Urban	−62	−65	−63	−55	−53	−52	−48	−50	−45	−41	−53

Source: Estimates based on data of the household budget survey, 2010–13.

Repeated cross section estimation of elasticities versus panel data has been discussed in the literature, and using subgroups of the population, and following them, has been recalled as pseudo-panel data approach. This methodology has been used to estimate price elasticities for products like alcohol or cars.[54,55]. For a comparison of panel data and cross section techniques, please review Deaton 1985, Giertz 2008 and Verbeek and Bella 2005. [56–58]

Appendix II

We estimate the model for four specific groups of the population: rural, urban, population under 40 years old, and over 40 years old. For the elasticities estimated for these populations (in Table A1), the mean results are as follows. We can see that for most income groups of the rural population, the effect of the tobacco tax is negative, but the effect is still progressive. On the other hand, for urban as well as for households with heads of young age, the effects tend to be positive as well as progressive.

Table A2 - Total Net Effect (%), by Income Decile, Age, and Location (%)

Price elasticity	*Decile 1*	*Decile 2*	*Decile 3*	*Decile 4*	*Decile 5*	*Decile 6*	*Decile 7*	*Decile 8*	*Decile 9*	*Decile 10*
Rural	25.9	-9.3	-11.8	-16.2	-22.0	-24.2	-17.3	-22.2	-26.5	-23.4
Urban	53.9	52.1	35.2	16.7	10.3	4.0	-1.0	1.5	-7.1	-10.3
Under age 40	81.9	59.1	50.3	36.4	20.3	17.5	7.7	15.4	-2.1	-3.8

Source: Proportion of household budget. Based on data of the 2013 household budget survey.

Note: The table shows the share of total consumption for each decile.