Distributional analysis considering long-run health benefits of increasing tobacco taxes in Argentina[♣]

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Key messages

- **Tax increases reduce tobacco consumption and relatively more so among low-income households. This reduction should be the ultimate aim of the tobacco tax policy**. In Argentina, a 10 percent increase in cigarette prices would decrease consumption by 7.5 percent for the less affluent smoker and by 4.9 percent for the more affluent ones. As less well-off individuals reduce consumption relatively more, they bear relatively lower tax burden from higher taxes.
- **Tobacco tax increases are not regressive.** In Argentina, those individuals with a higher price elasticity of demand for cigarettes are the less affluent ones. Thus, they will decrease consumption relatively more following price increases and will bear relatively less tax burden. Faced with a price increase of 18 percent, the poorest and the richest quintile would increase tobacco spending in a similar proportion as a share of income. Thus, tobacco tax increases tend to be more proportional than regressive.
- **The trend toward more progressive tobacco taxes is heightened when considering the long-run effects of a tax increase.** Higher taxes discourage consumption and save on future medical expenses associated with smoking-related diseases. They also generate an increase in lifetime earnings due to a lower risk of premature death. When these factors are taken into account, increasing tobacco taxes is a progressive policy. Due to higher taxes the poorest quintile would experience savings of about 1 to 4 percentage points of their income due to lower medical expenses and higher labor income.

Executive Summary

According to the U.S. National Cancer Institute and the World Health Organization (WHO) the global health and economic burden of tobacco use is enormous and is increasingly borne by low- and middle-income countries (LMICs) (NCI-WHO, 2016). Already, around 80 percent of smokers live in LMICs. While smoking prevalence is falling at the global level, the total number of smokers worldwide is still more than one billion, partly driven by population growth. Thus, there is a strong possibility that the global target of a 30 percent relative reduction in tobacco use by 2025, agreed to by WHO Member States, will not be met. The number of tobacco-related deaths is more than 8 million annually.

In this context, tobacco control can clearly help to save millions of lives as the scale of the epidemic demands continued attention and support. For this purpose, tobacco taxes are the most effective tobacco control intervention, yet the least implemented. A sufficiently large tax increase will raise tobacco product prices—making them less affordable—thereby discouraging initiation, encouraging quitting, and driving down consumption (Atlas, 2022).

How much tobacco consumption decreases after a price increase depends on the tobacco price elasticity (i.e., the responsiveness of the demand for tobacco to a change in its own price, holding all else equal). Thus, price elasticities are relevant for the evaluation of reforms that aim to increase tobacco taxes. For example, if tobacco consumption is price-inelastic (i.e., the consumption decrease is proportionally less than the price increase), higher taxation can increase fiscal revenues even while consumption decreases. In addition, if individuals across the income distribution exhibit different price elasticity of demand for tobacco products, the common assertion of tobacco tax regressivity (since less affluent smokers incur proportionately greater expenditures on cigarettes compared with more affluent smokers) may not hold. Those individuals with higher elasticity will decrease consumption relatively more following price increases and will bear relatively less tax burden. If those individuals are the less affluent, then a tax increase may not be regressive at all (Verguet et al., 2021; Cruces et al., 2022).

The trend toward more progressive tobacco taxes can be heightened when considering the long-run effects of a tax increase (Vulovic and Chaloupka, 2021). For example, if higher taxes discourage consumption, households can expect to save on future medical expenses associated with smoking-related diseases, and they can also expect an increase in lifetime earnings due to a lower risk of premature death and lower morbidity. As lower-income households consume

relatively more tobacco, savings in medical expenses and increases in future labor income will be relatively greater for them. Using an Extended Cost Benefit Analysis (ECBA), it is possible to determine empirically if increasing tobacco taxes would be a progressive policy (Fuchs and Meneses, 2017).

Argentina has recent findings on the effects of tobacco taxation previously. Regarding the heterogeneity in the tobacco consumption response, empirical evidence presents a range of estimates. Gonzalez-Rozada (2019) provides a lower bound estimation with a price elasticity of -0.35 (-0.21) for the poorest (richest) individuals. On the other hand, Cruces et al. (2020, 2022) provides an upper bound estimation, finding that while the elasticity for a person with the average income in Argentina is -0.62, this value is -0.78 for someone in the poorest decile. One reason for this range can be the type of data employed in the estimation of price elasticities since microdata from household surveys is more accurate to estimate tobacco consumption while time series data seems to perform better estimates for sales and revenues. In the ECBA, Cruces et al. (2020) show that when indirect effects are included in the analysis along with the heterogeneity in individual sensitivities to price changes, the increase in the tobacco tax is progressive and generates reductions in household spending for all deciles of the income distribution. Similar evidence for Latin American countries can be found in de los Ríos et al. (2020) for the case of Peru, Divino et al. (2020) for Brazil, and Gómez et al. (2020) for Mexico.

This report reinforces the previous conclusions by updating the ECBA with the addition of combining this analysis with recent simulations of tax reforms developed by CEDLAS (2022). Unlike previous studies, this report not only analyzes the effects on different income groups of an average change in the cigarette tax, but also uses specific price changes by quintile of income. Thus, it includes specificities by quintile in terms of elasticity and price changes. It also considers the latest available data on the cost of tobacco-related diseases provided by Pichon-Riviere et al. (2020).

Results show that increasing the price per pack of cigarettes has a direct impact on decreasing the demand for consumption of cigarettes and, as a result, increasing government revenues. Thus, the government of Argentina would contribute to improved health and wellbeing of its citizens by increasing tobacco taxation, and at the same time, generate significant and much needed additional budget revenues in a progressive manner. Specifically, an increase in the ad valorem rate of the tobacco internal tax (II) from 70 percent to 75 percent induces a price increase of 18 percent. In

this scenario, the poorest (richest) quintile would experience savings in the range of 1.1 to 1.7 (0.1 to 0.2) percentage points of their income due to lower medical expenses and higher labor income. Thus, tobacco taxation policy in Argentina should include a larger increase in the current ad valorem rate of the II.

1. Introduction

According to the U.S. National Cancer Institute and the World Health Organization (WHO) the global health and economic burden of tobacco use is enormous and is increasingly borne by low- and middle-income countries (LMICs) (NCI-WHO, 2016). Already, around 80 percent of smokers live in LMICs. While smoking prevalence is falling at the global level, the total number of smokers worldwide is still more than one billion, partly driven by population growth. Thus, there is a strong possibility that the global target of a 30 percent relative reduction in tobacco use by 2025, agreed to by WHO Member States, will not be met. The number of tobacco-related deaths is more than 8 million annually.

In this context, tobacco control can clearly help to save millions of lives as the scale of the epidemic demands continued attention and support. For this purpose, tobacco taxes are the most effective tobacco control intervention, but are also the least implemented. A sufficiently large tax increase would raise tobacco product prices—making them less affordable—thereby discouraging initiation, encouraging quitting, and driving down consumption (Atlas, 2022).

Worldwide evidence shows that tax increases reduce overall tobacco consumption, lead current users to quit, prevent youth from taking up tobacco, and reduce health and economic consequences (WHO, 2021a). The effect of taxes on the reduction in tobacco consumption can be heterogeneous according to the income level of the countries, the income of the smokers, and their age, among other factors. How much tobacco consumption changes following higher prices depends on the price elasticity of demand for tobacco (i.e., the responsiveness of the demand for tobacco to a change in its own price, holding all else equal), which is a key parameter to evaluate reforms on tobacco taxation. If tobacco consumption is price-inelastic (i.e., the consumption decrease is proportionally less than the price increase) higher taxation can increase fiscal revenues even while consumption decreases (Ranson et al. 2000; Gonzalez-Rozada, 2006; NCI-WHO, 2016; Rodriguez-Iglesias et al., 2017).

Furthermore, if individuals across the income distribution exhibit different price elasticities of demand for tobacco products, the common objection about the regressivity of increasing tobacco taxes (large increases in price—as a consequence of higher taxes—lead less affluent smokers to incur proportionately greater expenditures on cigarettes compared with more affluent smokers, Verguet et al., 2021) may not hold. Those individuals with higher price elasticity will decrease consumption relatively more following price increases and, thus, they will bear relatively

less tax burden. If those individuals are the less affluent, then a tax increase may not be regressive at all.

The trend toward more progressive tobacco taxes can be heightened when considering the long-run effects of a tax increase (Vulovic and Chaloupka, 2021). For example, if higher taxes discourage consumption, households can expect to save on future medical expenses associated with smoking-related diseases, and they can also expect an increase in lifetime earnings due to a lower risk of premature death and lower morbidity. As lower-income households consume relatively more tobacco, savings in medical expenses and increases in future labor income will be relatively greater for them. Using Extended Cost Benefit Analysis (ECBA), it is possible to test empirically if increasing tobacco taxes would be a progressive policy (Fuchs and Meneses, 2017). Similar evidence for Latin American countries strongly suggesting that tobacco taxation is progressive can be found in de los Ríos et al. (2020) for the case of Peru, Divino et al. (2020) for Brazil, and Gómez et al. (2020) for Mexico.

In this report, the authors update the ECBA by combining this analysis with recent simulations of tax reforms scenarios developed by CEDLAS (2022). Specifically, the report simulates changes in cigarette expenditure, medical expenses, and labor incomes because of higher prices of cigarettes resulting from two tax reform scenarios. One scenario proposes to raise the ad valorem rate of the internal tax (II) and results in an increase in the price of cigarettes of approximately 18 percent on average. A second scenario proposes to modify the structure of the II by establishing a unique specific tax (i.e., replacing the ad valorem rate by a fixed specific rate). The level of this specific tax is set according to the economic costs of smoking, in terms of direct medical care that tobacco use imposes. This scenario results in an increase in the price of cigarettes of approximately 41 percent on average. The report also considers the implications of income group-specific elasticities for the distributional impacts of tobacco taxes.

The remainder of the report is structured as follows. Section 2 briefly describes tobacco consumption in Argentina, as well as tobacco taxation in the country. Section 3 describes the methods. Results are presented in Section 4. Final comments are presented in Section 5.

2. Tobacco consumption and taxation in Argentina

Consumption. In Argentina, there are 9 million smokers (over a total population of 45 million inhabitants) and tobacco consumption causes 45 thousand deaths per year (Alcaraz et al., 2020).

Since 2011, the prevalence of tobacco use (i.e., cigarettes) has decreased. According to the latest National Survey of Risk Factors (ENFR for its acronym in Spanish), in 2018 the prevalence of cigarette consumption[1] in the adult population was 22.2 percent, 7.5 percentage points below the prevalence registered in 2005. The prevalence in cigarette consumption was 26.1 percent for men and 18.6 percent for women, while the lowest prevalence was observed in the two age extremes (under 25 years and 65 years and over). According to the level of education, those with incomplete secondary education had a higher prevalence (26.1 percent) than those with complete secondary education and more (20.1 percent).

The average cigarette consumption during 2020 was 140 million packs per month. Consumption is mostly concentrated on manufactured cigarettes (97.2 percent of current smokers) that have few substitute products (e.g., the consumption of bidis, gutka, or loose tobacco is not common in Argentina). Argentina ranks 68 out of 176 countries in terms of how cheap it is to consume cigarettes (WHO, 2021b).

Taxation. The tax structure on cigarette consumption in Argentina is very complex (Gonzalez-Rozada, 2020). There are four federal taxes affecting cigarettes:

i) the additional emergency tax (IAE), with a rate of 7 percent of the retail price (RP);
ii) the value-added tax (VAT) with a rate of 21 percent;
iii) the FET with a rate of 8.35 percent and a fixed additional component per cigarette pack;[2] and
iv) the internal tax (II), with an ad valorem rate of 70 percent.[3]

The tax base of each tax is different. For example, II is applied over RP excluding IAE, VAT, and FET. VAT´s base is RP excluding IAE, II, and FET. Finally, FET is applied over RP excluding IAE and VAT. One additional tax is levied at the subnational level: the turn-over tax with an ad valorem rate that varies depending on the province.

3. Methods

The authors estimate the ECBA by combining the most recent Household Expenditure Survey (ENGHO 2017/2018) with the price elasticities of demand for cigarettes by income groups (i.e.,

[1] Defined from those who smoked more than 100 cigarettes in their lifetime and who currently smoke cigarettes.
[2] This fixed amount was set at around 4 pesos in May 2021. This amount is updated periodically.
[3] The II cannot be less than a minimum tax that is updated by the consumer price index (CPI).

quintiles) computed in Cruces et al. (2022) and with price changes resulting from tobacco tax reforms simulations developed in CEDLAS (2022). The price elasticities of demand for cigarettes are presented in Table 1.[4] The authors estimate expenditure on tobacco, health expenditure, and labor income at individual level and simulate changes in tobacco expenditure considering that elasticity varies by income group. Then, the results are presented aggregated by income groups.

Table 1. Price elasticities of demand for cigarettes in Argentina, by quintiles of household per capita income: prevalence, consumption, and total elasticities.

	Prevalence	Consumption	**Total Price Elasticty**
1	-0,014	-0,736***	-0,75***
	(0,0137)	(0,0077)	(0,006)
2	-0,01	-0,663***	-0,672***
	(0,0053)	(0,0101)	(0,0048)
3	-0,007	-0,618***	-0,625***
	(0,0001)	(0,0116)	(0,0114)
4	-0,004**	-0,574***	-0,578***
	(0,0049)	(0,0129)	(0,0178)
5	0,001***	-0,498***	-0,497***
	(0,0137)	(0,0155)	(0,0292)
Average	-0,007***	-0,618***	-0,624***
	(0,0001)	(0,0116)	(0,0115)

Source: Cruces et al. (2022). Note: Standard errors in parentheses, calculated using bootstrap, with 100 repetitions. Statistical significance ***p<0.01, **p<0.05, *p<0.1.

Fuchs and Meneses (2017) propose to calculate the total effect of a change in the tobacco taxes on the *j* quintile income as:

$$\Delta\, Income_j = \underbrace{\Delta\, tobacco\ expenditure_j}_{1} + \underbrace{\Delta health\ expenditure_j}_{2} + \underbrace{\Delta\, labor\ income_j}_{3}$$

The first term on the right (1) is the direct effect of the tax change, which depends on the price elasticity of the demand for cigarettes of quintile *j* and the share of cigarette expenses in total expenditures. The second term (2) considers the changes in health-related expenses given the

[4] In the simulations only total price elasticities (i.e., last column in Table 1) are used.

decrease in need of treatments for smoking-related diseases; and the third term (3) represents the changes in income given that smokers will likely work for a longer period due to longer life expectancy.

To calculate the variation in tobacco expenditure (1) given a tax change, the authors compute the share of expenditure on tobacco in total expenditure using ENGHO 2017/2018. The authors then combine this share with the change in prices of two reforms proposed in CEDLAS (2022) to increase tobacco taxes in Argentina (see below), and with the elasticity of demand by quintiles estimated in Cruces et al. (2022). The change in tobacco expenditures—as a share of income—is calculated by household depending on cigarette consumption, considering demand specific variability, such as the price of cigarettes and the price elasticity of demand for cigarettes associated with their corresponding income quintile. The authors estimate the variation in tobacco consumption after the tax increase, considering the change in prices (*ΔP*), the tobacco price elasticity (e), and the tobacco expenditure of quintile j in period 0 ($Expenditure_{j0}$). That is, $\Delta\ tobacco\ expense_j = ((1 + \Delta\mathrm{P})(1 + e * \Delta\mathrm{P} - 1)) * \mathrm{Expenditure}_{j0}$. Note that *ΔP*, is the change in prices by income group obtained from the tax simulations developed in CEDLAS (2022).

To estimate the change in health expenditures (2) the authors combine the elasticity data with data on the cost of smoking-related diseases and deaths attributed to tobacco-related causes in Argentina. As the analysis examines the effect of higher taxes at the population level, the authors analyze the healthcare cost. The calculations are modeled on Pichon-Riviere et al. (2020), which estimated the cost for treating smoking-related diseases in Argentina. Tobacco-related diseases for the year 2020 represented a direct annual cost of 3,817 million dollars, of which 37 percent was attributable to smoking. This cost is distributed across the income groups of the household expenditure survey according to the share of smoked cigarettes related to the total cigarettes smoked in Argentina. This is, if total cigarette consumption in Argentina is 100, and an individual smokes 1 cigarette, the authors impute to that person 1 percent of the total cost of tobacco related diseases calculated by Pichon-Riviere et al. (2020). Then, the results are presented aggregated by income groups.

To calculate the change in projected labor income related to the reduced likelihood of premature death (3), the authors combine data from Pichon-Riviere et al. (2020)[5] and data obtained from the household expenditure survey to estimate the reduction on years and quality of life lost by smoking. Labor income losses due to premature death or morbidity-related loss of productivity are imputed, considering their share in the total consumption of tobacco in Argentina, and the results are presented aggregated by income groups.

For microsimulation purposes, changes in prices due to higher taxes on tobacco arise from simulation performed by CEDLAS (2022). Specifically, the authors consider 2 tax reforms:

- Tax reform 1: An increase in the II rate from 70 percent up to 75 percent. An 18.3 percent—on average—cigarette price increase for all the smokers is obtained in this tax reform.
- Tax reform 2: An alternative design of the II. Specifically, the current II is replaced by a new II with a mixed structure. CEDLAS (2022) use a specific fixed tax of $99.37 per pack combined with an ad valorem rate of 20 percent. In this case a 41.6 percent—on average—cigarette price increase for all the smokers is obtained.

Following CEDLAS (2022), the specific tax in Tax reform 2 considers the health care cost of smoking in Argentina per pack of cigarettes. According to the Institute of Clinical and Sanitary Effectiveness (IECS), smoking kills 123 people per day and costs $196 billion per year for medical care in hospitals and health centers (IECS, 2020). Considering this monetary cost (i.e., around $196.987 million) and the annual sales of cigarette packs in Argentina (i.e., around 1.982 million), CEDLAS (2022) define the II specific tax at $99.37 (i.e., 196.987 / 1.982).[6]

The authors simulate the impact of varying the assumptions about the change in price and the price elasticity of demand. For example, in the case of Tax reform 1, the authors use the average price change for all households (18.3 percent) and the average price elasticity of demand for all households (-0.6). The authors allow for heterogeneity in these parameters by using i) quintile specific price change (using the variability of unit values provided by the ENGHo). The change in prices that faces each quintile is 20.2 percent, 18.7 percent, 18.3 percent, 18.3 percent, and 17.2 percent, respectively; and ii) quintile specific price elasticity of demand for each quintile, as shown by Cruces et al (2022).

[5] 1,072,979 years of life are lost in Argentina per year due to tobacco consumption.
[6] Note that this scenario completely changes the structure of the tax, leaving only one specific tax per pack of cigarettes.

4. Results

Figure 1 shows the proportional change in cigarette expenditure and the total effects of Tax reform 1. In Panel A, the blue bars assume the average elasticity is the same for all the smokers, and all the smokers face the same change in price (i.e., 18.3 percent price increase). Note that all individuals react equally according to the average elasticity. In this case, an increase in the price of cigarettes following a tax increase would be regressive, as it would disproportionately affect expenditures of less affluent smokers. The poorest (richest) quintile would increase its tobacco expenditures—as a share of income—by 0.20 (0.03) percentage points.

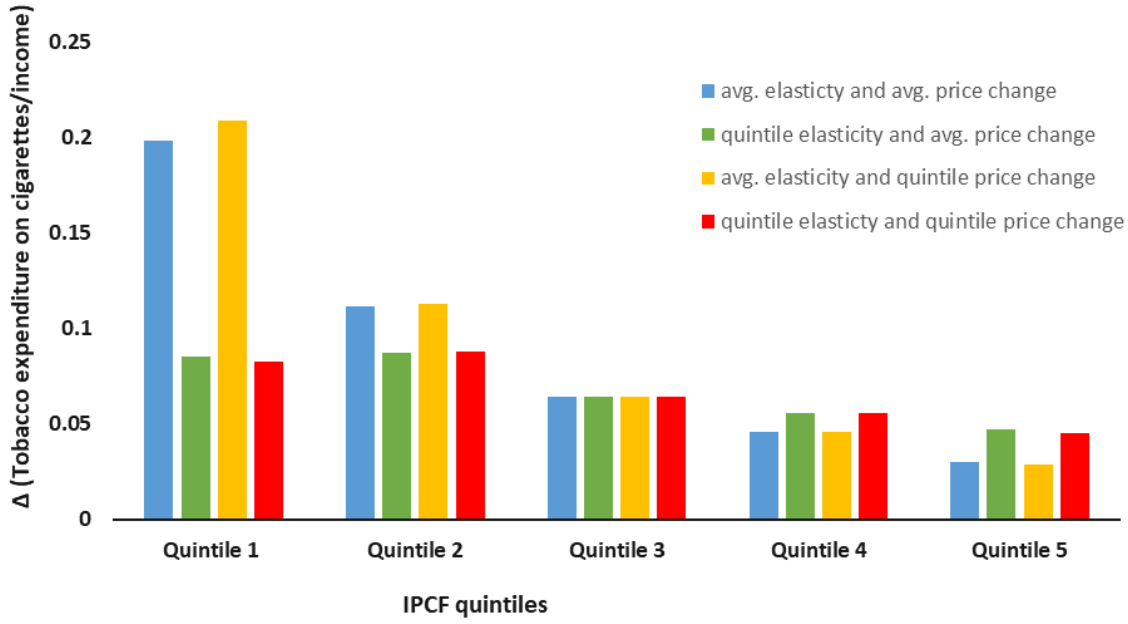
Alternatively, the green bars assume that the price elasticity varies across income groups, while all the smokers face the same change in price (i.e., 18.3 percent). Note that all individuals react according to the price elasticities corresponding to their income group. Now, the poorest quintile would increase its share of tobacco spending in relation to income by 0.09 percentage points, while the richest quintile would increase it by 0.05. The second, third, and fourth quintile experience changes in tobacco expenditure relative to their income very similar in magnitude relative to quintile 1. Thus, tobacco tax increases are more neutral when the price elasticities of demand for each income group is considered.

The yellow bars and red bars show the proportional change in cigarette expenditure, but assume that price changes are quintile specific. In the first case, the poorest quintile would increase its share of tobacco spending in relation to income by 0.21 percentage points, while the richest quintile would increase it by 0.03. In the second case, the changes are 0.08 and 0.05, respectively. Again, results indicate that tobacco tax increases are more neutral when income group-specific price elasticity of demand is considered. These results are in line with the aforementioned results and reinforce the relevance of income group-specific price elasticity. Thus, the assumption on the price elasticity of demand for tobacco products shows strong policy implications in terms of tax incidence of increasing tobacco taxes.

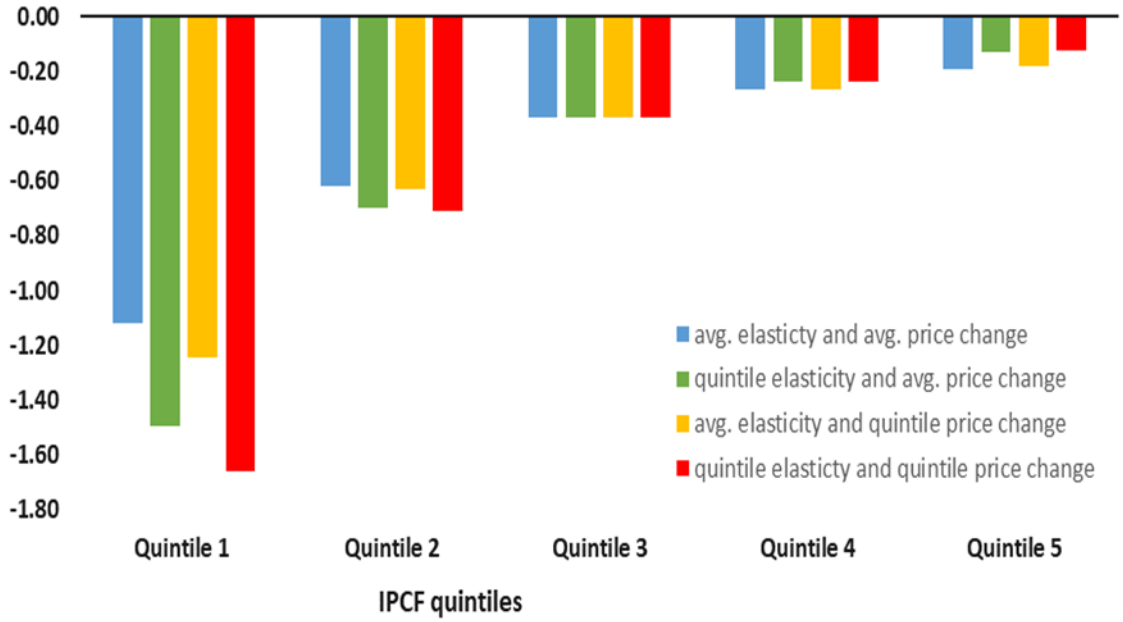
Panel B of Figure 1 shows that by incorporating indirect effects (on health spending and labor productivity), a change in the price of cigarettes has a progressive pattern and is, in fact, beneficial for all the quintiles of the distribution. The poorest (richest) quintile would experience savings in the range of 1.1 to 1.7 (0.1 to 0.2) percentage points of their income due to lower medical expenses and higher labor income.

Figure 1. Extended Cost Benefit Analysis (ECBA) of a change of cigarette taxes in Argentina. Change in expenditure on cigarettes as a share of income. By quintiles of household per capita income. In percentage points

Panel A. Direct effects of an increase in cigarette taxes



Panel B. Total effects of an increase in cigarette taxes



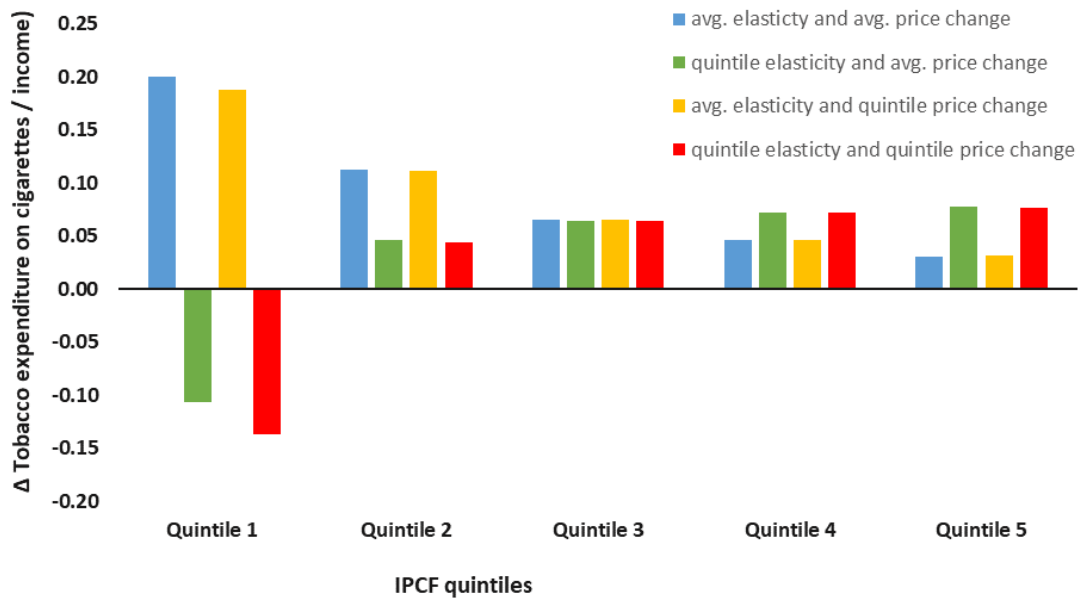
Source: Own elaboration. Note: Panel A shows only the first term considered in equation 1 of section 2. Panel B shows the total of the 3 effects considered. The change in prices that faces each quintile is 20.2%, 18.7%, 18.3%, 18.3%, 17.2%, respectively. Quintile specific elasticity is reported in Table 1.

Figure 2 shows the proportional change in cigarette expenditure and the total effects for Tax reform 2. Although Tax reform 2 increases price by about 41.6 percent on average, or approximately twice the increase in Tax reform 1, the previous conclusion is consistent. Tobacco tax increases become progressive when the income group-specific price elasticity of demand is considered. Now, the poorest quintile would reduce its share of tobacco spending in relation to income by about 0.11 percentage points, while the richest quintile would increase it by 0.08. The reason why smokers in the first quintile reduce their spending is that they are very elastic to changes in cigarette prices and, in turn, face very considerable changes in prices.[7] By incorporating indirect effects, the poorest (richest) quintile would experience savings in the range of 2.7 to 4.0 (0.3 to 0.5) percentage points of their income due to lower medical expenses and higher labor income. Overall, it is worth noting how large tax increases may result in marginally progressive cigarette taxes even when only considering a change in cigarette expenditure. But, even more important, when considering the indirect effect, all of them are marginally progressive.

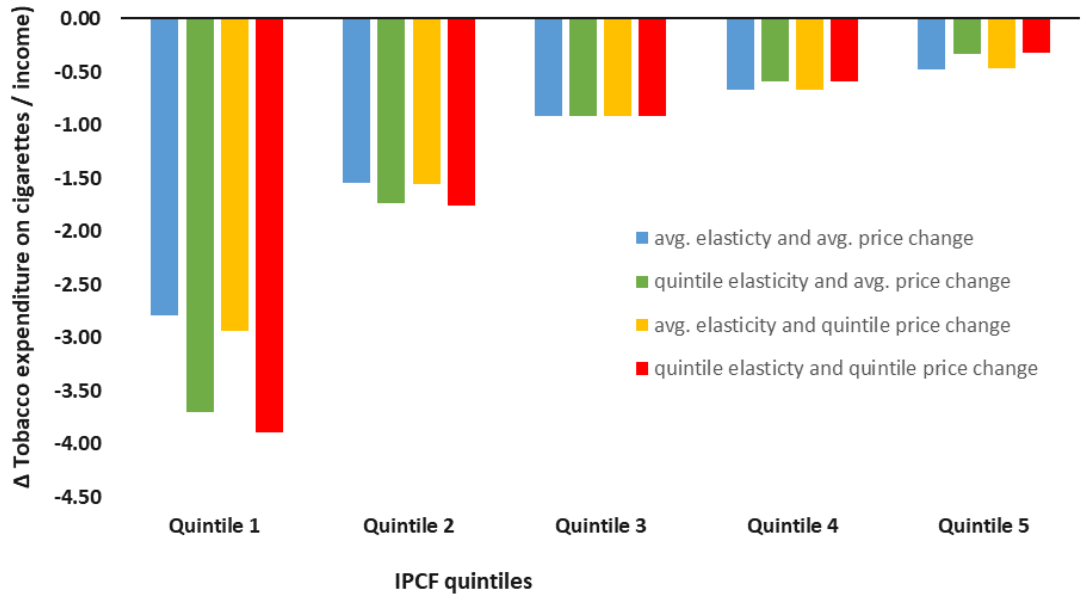
[7] Given that the fall in the expenditure of the first quintile may be a priori counterintuitive due to the fact that the price elasticity of demand is less than one in absolute value, in Appendix 1 to this report, the authors show that this result is consistent with certain values of price elasticity demand and price changes. Briefly, while this is the correct way to reason for a marginal change in price, when dealing with large changes (as in this scenario, a 40% price change), the marginal analysis is not equal to the exact change in expenditure.

Figure 2. Extended Cost Benefit Analysis (ECBA) of a change on cigarette taxes in Argentina. Change in expenditure on cigarettes as a share of income. By quintiles of household per capita income. In percentage points

Panel A. Direct effects of an increase in cigarette taxes



Panel B. Total effects of an increase in cigarette taxes



Source: Authors' elaboration. Note: Panel A shows only the first term considered in equation 1 of section 2. Panel B shows the total of the 3 effects considered. The change in prices that faces each quintile is 43.5%, 42.0%, 41.6%, 41.6%, 40.5%, respectively. Quintile specific elasticity is reported in Table 1.

5. Final comments

This report accounts for the indirect effects generated by changes in cigarette prices. Indirect effects impact individual expenditures by reducing medical expenses related to the treatment of diseases caused by smoking and increasing expected lifetime labor income, a result of a lower likelihood of contracting tobacco related diseases and facing premature death. The results of this broader analysis indicate that if only the direct effects of an increase in cigarette prices are taken into account (that is, the change in the proportional expenditure on cigarettes by individuals) and individual sensitivities to price change are not taken into account, an increase in the tobacco tax will be read as regressive, meaning the burden would appear to disproportionately fall on the poorest households. However, if indirect effects and quintile specific price elasticity of demand for cigarettes are taken into consideration, the increase in tobacco taxation is in fact, progressive, and it generates savings in household expenditures for all the income distribution.

In sum, this research suggests that increases on tobacco taxes in Argentina would not harm welfare, especially for the poorest sectors. Reductions in tobacco consumption result in better health, lower medical expenses, increased expected years of life, and more time for income generating activities. When considering the decreased medical expenses and higher labor income, a tax increase that effectively raises cigarette prices by 18.3 percent would result in about 1.7 percentage points of savings for the poorest quintile, resulting in savings in income. These effects can be significantly enhanced with more aggressive tax increases.

The policy recommendations that emerge from this study highlight the importance of a legislative agenda that promotes increases in the taxation of tobacco in Argentina. Tobacco taxation policy in Argentina should include a larger increase in the current ad valorem rate of the II. The government could contribute to improved health and wellbeing of its citizens by increasing tobacco taxation, and at the same time, generate significant and much needed additional budget revenues in a progressive manner. This can be done with alternative designs of the existing II tax that effectively counter arguments used to block the possibility of reforming the current tobacco tax structure, such as claims of the regressivity of increasing tobacco taxes.

References

- Alcaraz A, Hernández Vasquez A, Palacios A, et al. Health and Economic Impact of Health Warnings and Plain Tobacco Packaging in Seven Latin American Countries: Results of a Simulation Model. *Nicotine Tob. Res*. 2020;22(11):2032-2040.
- Asaria P, Chisholm D, Mathers C, et al. Chronic disease prevention: health effects and financial costs of strategies to reduce salt intake and control tobacco use. *The Lancet* 2007; 370(9604):2044-2053
- Atlas (2022). The Tobacco Atlas — a partnership between Vital Strategies and Tobacconomics at the University of Illinois Chicago. See here.
- Centro de Estudios Distributivos Laborales y Sociales (CEDLAS). (2022). "On the analysis of tobacco tax reforms in Argentina". Draft Report.
- Cruces G, Falcone G, Puig J. Differential price responses for tobacco consumption: implications for tax incidence. *Tobacco Control* Published Online First: 11 January 2022. doi: 10.1136/tobaccocontrol-2021-056846
- Cruces, G., Falcone, G., and Puig, J. 2020. "Tobacco taxes in Argentina: Toward a comprehensive cost-benefit analysis". CEDLAS, Working Papers, CEDLAS, Universidad Nacional de La Plata. 2020.
- de los Ríos, C., Medina, D., & Aguilar, J. (2020). Cost-Benefit Analysis of Tobacco Consumption in Peru [Report]. IEP. https://www.tobacconomics.org/files/research/614/iep-2019-policy-report-en-edv5-1.pdf
- Divino, J.A., Ehrl, P., Candido, O., & Valadão, M. (2020). An Extended Cost-Benefit-Analysis of Tobacco Taxation in Brazil [Report]. UCB. https://www.tobacconomics.org/files/research/9/policy-report-ucb-en-1.pdf
- Fuchs A, Meneses F. Are tobacco taxes really regressive? Evidence from Chile. The World Bank. 2017.
- Gómez, A.G., Macías, A., Páez, H.J.V., & Méndez, J.S.M. (2020). Extended Cost-Benefit Analysis of Tobacco Consumption in Mexico [Report]. CIEP. https://www.tobacconomics.org/files/research/605/extended-cost-benefit-analysis-tobacco-ciep-en.pdf
- González-Rozada M. Economía del control del tabaco en los países del Mercosur y estados asociados: Argentina: 1996-2004. Washington, DC: PAHO, 2006.
- Gonzalez-Rozada M. Increasing Cigarette Taxes is Unfair to the Poor? Evidence from Argentina. Dep of Econ Working Papers 2019, Universidad Torcuato Di Tella.
- Instituto de Efectividad Clínica y Sanitaria, IECS. 2020. "Radiografía de una epidemia. Argentina. La importancia de aumentar los impuestos al tabaco".
- Laxminarayan R, Ashford L. Using evidence about 'best buys' to advance global health. Policy Brief: Disease Control Priorities Project. 2008.
- Pichón-riviere, Andres; Alcaraz, Andrea; Palacios, Alfredo; Rodríguez, Belén; Reynales Shigematsu, Luz Myriam; et al.; The health and economic burden of smoking in 12 Latin American countries and the potential effect of increasing tobacco taxes: an economic modelling study; Elsevier; The Lancet Global Health; 8; 10; 10-2020; e1282-e1294
- Ranson K, Jha P, Chaloupka F, et al. Effectiveness and cost effectiveness of price increases and other tobacco-control policies. Tobacco control in developing countries. Oxford University Press 2000;427-447.

- Rodríguez-Iglesias G, Schoj V, Chaloupka F, et al. Analysis of cigarette demand in Argentina: the impact of price changes on consumption and government revenues. *Salud Publica Mex*. 2017;59(1):95-101.
- U.S. National Cancer Institute and World Health Organization. (NCI-WHO). The Economics of Tobacco and Tobacco Control. National Cancer Institute Tobacco Control Monograph 21. NIH Publication No. 16-CA-8029A. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; and Geneva, CH: World Health Organization. 2016.
- Verguet S, Kearns PKA, Rees VW. Questioning the regressivity of tobacco taxes: a distributional accounting impact model of increased tobacco taxation. *Tob Control* 2021; 30:245-257.
- Vulovic V, Chaloupka FJ. Questioning the regressivity of tobacco taxes: a distributional accounting impact model of increased tobacco taxation—commentary. *Tob Control* 2021; 30:260-261.
- World Health Organization. Technical manual on tobacco tax administration. Geneva, World Health Organization, 2010.
- World Health Organization. WHO report on the global tobacco epidemic 2015: raising taxes on tobacco. World Health Organization. 2015
- World Health Organization. WHO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies. World Health Organization. 2017.
- World Health Organization. WHO report on the global tobacco epidemic 2021: addressing new and emerging products; 2021b.
- World Health Organization. WHO technical manual on tobacco tax policy and administration. Geneva: World Health Organization; 2021a.

Appendix 1. On the change in spending on cigarettes in response to changes in prices.

Total expenditure can be easily computed as price multiplied by quantity.

$$e = pq$$

The first, and maybe most, used way to compute the change in expenditure when price change, is to compute a total differential of expenditure.

$$\mathrm{d}e = dpq + pdq$$

It is useful to remember that the total differential of a function f at a point is the best linear approximation ***near*** this point of the function with respect to its arguments. Unlike partial derivatives, the total differential approximates the function with respect to all its arguments, not just a single one.

Operating, a useful expression can be obtained:

$$\mathrm{d}e = dp\,q + p\,dq$$

$$de = dp\,q + \frac{dq}{dp}\frac{p}{q}\,dp\,q$$

$$de = dp\,q + \epsilon\,dp\,q$$

$$de = dpq(1 + \epsilon)$$

$$\frac{de}{dp} = q(1 + \epsilon)$$

So, when using total differential to compute the change in expenditure, if elasticity is below one in absolute terms, when prices go up, so does expenditure. This is fully suitable for a marginal change in prices. However, the total differential does not replicate the exact change in expenditure, given that it uses derivatives, which are a linear approximation of real changes. To compute the exact change in expenditure, it becomes necessary to define expenditure in two moments, before and after the price change.

$$e_0 = p_0 q_0$$

$$e_1 = (p_0 + \Delta p)(q_0 + \Delta q)$$

Now, computing the change in expenditure:

$$\Delta e = e_1 - e_0$$

$$\Delta e = (p_0 + \Delta p)(q_0 + \Delta q) - p_0 q_0$$

$$\Delta e = p_0 q_0 + \Delta p q_0 + \Delta q p_0 + \Delta p \Delta q - p_0 q_0$$

$$\Delta e = \Delta p q_0 + \Delta q p_0 + \Delta p \Delta q$$

Note that the last term of the equation, $\Delta p \Delta q$, is the only difference when comparing with the change calculated using total differential. The term $\Delta p \Delta q$ is a second order effect and is close to zero when the change in prices is small. So, in standard microeconomics, when using marginal change, this term is not computed in the linear approximations. However, in this case in Scenario 2, this term becomes relevant. Operating a little more:

$$\Delta e = (p_0 + \Delta p)(q_0 + \Delta q) - p_0 q_0$$

$$\Delta e = (p_0 + \Delta p)\left(q_0 + \frac{\Delta \mathrm{q} q_0 \mathrm{p}_0 \Delta \mathrm{p}}{\Delta \mathrm{p} p_0 \mathrm{q}_0}\right) - p_0 q_0$$

$$\Delta e = (p_0 + \Delta p)\left(q_0 + \frac{\Delta \mathrm{q} q_0 \mathrm{p}_0 \Delta \mathrm{p}}{\Delta \mathrm{p} p_0 \mathrm{q}_0}\right) - p_0 q_0$$

$$\Delta e = (p_0 + \Delta p)\left(q_0 + \epsilon \frac{\mathrm{q}_0 \Delta p}{p_0}\right) - p_0 q_0$$

$$\Delta e = p_0 (1 + \Delta p) q_0 \left(1 + \epsilon \frac{\Delta p}{p_0}\right) - p_0 q_0$$

$$\Delta e = p_0 (1 + \Delta p) q_0 \left(1 + \epsilon \frac{\Delta p}{p_0}\right) - p_0 q_0$$

$$\Delta e = p_0 q_0 \left[\left(1 + \frac{\Delta p}{p_0}\right)\left(1 + \epsilon \frac{\Delta p}{p_0}\right) - 1\right]$$

This is the same equation used by Fuchs and Meneses (2017), in their equation (3). As can be appreciated, now the relation with price elasticity of demand is not so clear. The term between brackets could be lower than zero even with an elasticity below one in absolute terms. In fact, it can be demonstrated that given an elasticity of -0.75, which is the value of the first quintile in the report, with changes in prices lower than 34%, expenditure goes up, but with changes above 34%, expenditure goes down. The simulation uses a 41.6% increase in prices on average. To proof this, use the last equation,

$$\left[\left(1 + \frac{\Delta p}{p_0}\right)\left(1 + \epsilon \frac{\Delta p}{p_0}\right) - 1\right] < 0$$

$$\left[\left(1 + \frac{\Delta p}{p_0}\right)\left(1 + \epsilon \frac{\Delta p}{p_0}\right)\right] < 1$$

$$1 + \epsilon\frac{\Delta p}{p_0} + \frac{\Delta p}{p_0} + \epsilon\left(\frac{\Delta p}{p_0}\right)^2 < 1$$

$$\epsilon\frac{\Delta p}{p_0}[1 + \frac{\Delta p}{p_0}] < -\frac{\Delta p}{p_0}$$

$$\epsilon[1 + \frac{\Delta p}{p_0}] < -1$$

Assuming $\epsilon = -0.75$,

$$\frac{\Delta p}{p_0} > 0.34$$

So, given the price elasticity, for price changes above this cut-off value, total expenditure will reduce.