Extended cost - benefit analysis of tobacco consumption in Mexico

Somos un **centro de investigación de la sociedad civil**, *sin fines de lucro y apartidista*, que contribuye a la comprensión de la economía y finanzas públicas en México, mediante herramientas y análisis accesibles y técnicamente sólidos, **para lograr una sociedad más informada y participativa**, mejorar las políticas públicas y construir un sistema fiscal **en beneficio de las generaciones presentes y futuras**.

Cost Benefit Analysis of Tobacco Consumption in México

Alejandra Macías Sánchez
alejandramacias@ciep.mx

Héctor J. Villarreal Páez
hectorvillareal@ciep.mx

Judith S. Méndez Méndez
judithmendez@ciep.mx

Adrián García Gómez
adriangarcia@ciep.mx

Centro de Investigación Económica y Presupuestaria, A.C.

December 20, 2019

Contents

1 | Introduction

Tobacco Consumption worldwide is one of the most shocking signs regarding the health condition of the world population. Based on information from the World Health Organization (WHO), smoking is the first cause of death in the world, one that can be avoided. In 2018, around eight million people died from tobacco consumption-related diseases (WHO, 2019).

Around one third of the world population smokes, which may translate into a health crisis given that the great majority of these individuals would require medical treatments for tobacco-consumption diseases, such as lung cancer, heart conditions and even diabetes and hypertension – as smoking may be a risk factor for these diseases. The number of people that die from smoking-related causes in the Americas is of about 1.5 million. Half of that number are people living in Latin America and the Caribbean. In Mexico, the prevalence of tobacco consumption has been steady in the period 2009-2015, representing around 16% of the population: 25% men and 8% women (SSa, 2015).Based on the National Survey on Drug, Alcohol and Tobacco Consumption Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco (ENCODAT), 3 thousand people die every year due to tobacco-related diseases (8.4% of the total number of deaths) (Instituto Nacional de Salúd Pública, 2017).

Tobacco consumption has become a huge problem, World Health Organization (WHO) has stated that it should be tackled through policies aiming at directly reducing the demand of this product (WHO, 2014). One of these policies implies taxing tobacco consumption, increasing its price as a result. There is evidence showing that in countries of all income levels, an increase on tobacco price entails a reduction in demand, tobacco consumption among minors, and a proclivity of relapsing among those people who have quit smoking at any given point. Studies show that, in face of an 10% increase in the price of cigarettes, it has been observed a 4-5% decrease in demand (WHO, 2014).

However, the counter-argument to the policy taxing tobacco products is that increasing the price of tobacco products results in a regressive measure as the percentage of total expenditure incurred by lower-income households who destine money to buy tobacco tends to be higher than those with a higher income.

This document is intended to show that if the indirect effects are taken into consideration, especially health effects resulting from reducing cigarette smoking, this statement is not correct. Among the benefits that can be seen there is a reduction in medical bills and an increase in years of a healthy life, which all translate into financial benefits for people and their households.

The Cost-Benefit Analysis is based on the assessment of different price increase scenarios, considering price-elasticity for different income groups. The Tobacco Consumption Price-Elasticity ratio will define how sensible the different income groups will be towards the increase in the price of tobacco products. An analysis of the optimal tobacco tax is included. Such optimal tobacco tax is defined as the taxing level that would result in the tax collection that is necessary to cover the health costs incurred by consuming tobacco in Mexico.

Document Layout

The Study is divided as follows: Section Two describes the State of the Art on taxes to tobacco products in Mexico, as well as the cost-benefit ratio of this policy. Section Three presents the objective of this document. Section Four describes the methodologies used while Sections Five and Six show the data used and the results obtained, respectively. The final section includes the political implications.

Study Objective

The objective of this research is to conduct a thorough cost-benefit analysis of tobacco consumption in Mexico, estimating the financial, social and health costs incurred by consuming tobacco, as well as the mid-term impact of reducing these costs resulting from the increase in tobacco taxes.

2 | State of the art

2.1 Taxes on tobacco in Mexico

There are three taxes on cigarettes in Mexico. These taxes have been subject to changes over the years. This section includes an explanation of each one of these taxes, as well as the main changes that have taken place over time.

2.1.1 Value added tax

Value Added Tax (VAT) is a tax levied on goods and services sold in Mexico[1].This tax is levied on a staggered basis – i.e. it is based on the added value that each stage of the production or distribution chain gives to the product or service. For cigarettes, VAT is applicable to all products manufactured in Mexico as well as those that were imported.

The Value Added Tax Law (Cámara de Diputados del H. Congreso de la Unión, 2016a) was introduced in December 1978, but was not effective until January 1988. The main changes in the Tax Rate are shown in Table 2.1.

2.1.2 Import taxes

The Import Tax is the tax imposed on products that are imported into Mexico. This tax was first introduced in 1988 and has undergone just one change. The initial rate on imported cigarettes was 20% over the value of a pack and increased to 67% in 1999 (SE, 2018).

2.1.3 Excise taxes

The Impuesto Especial a Producción y Servicios (IEPS) is a type of tax that is not only intended to collect taxes as such, but also correct the negative external factors resulting from consuming some products. IEPS imposes taxes on alcoholic beverages, gasoline, junk food, and cigarette, among other products.

[1] Except for some products, such as food and drugs.

Table 2.1. VAT rate evolution

Período	Tasa general	Tasa en frontera
1980 – 1882	10%	10%
1983 – 1987	15%	15%
1988 – 1991	15%	6%
1992 – 1994	10%	6%
1995 – 2009	15%	10%
2010 – 2013	16%	11%
2014 – 2018	16%	16%
2019 –	16%	8%

Source: Cámara de Diputados del H. Congreso de la Unión (2016a).

IEPS is applied by the time it is sold on retail or when products are imported.

Over time, IEPS rate on cigarettes has undergone several changes and revisions in its structure. This type of tax has changed from an ad valorem tax to a mixed tax with a specific component and an ad valorem component. The main changes on the IEPS to cigarettes are summarized in table 2.2.

In addition to the changes on the tax rate shown above, theLey del Impuesto Especial sobre Producción y Servicios (LIEPS) introduced several measures aimed at improving tax collection and management. The most relevant measures are listed below.

- Since 1992, cigarette producers and importers must report the sale price to the Sistema de Administración Tributaria (SAT), as well as the value of each product sold and/or imported, via electronic means.
- Since 1999, cigarette importers must be registered in an Importers Roster List managed by SAT.
- Since 2005, cigarette packs must include a Stamp Duty. The Stamp Duty was only used in 2005. It was not until 2014 that it was replaced by a security code that must

Table 2.2. IEPS rate evolution

Years	General rate	Popular cigarettes rate	Tax per cigarette	Notes
1981 – 1885	139.3%	20.9%	NA	Producers whose production was under 40,000 packs per year and whose brands and tobacco used were of Mexican origin did not pay IEPS. This measure was repealed in 1990 with a 25% IEPS Tax Rate, which kept on increasing until paying the full IEPS as of 1993.
1986 – 1988	180.0%	25.0%	NA	
1989 – 1994	160.0%	25.0%	NA	
1995 - 1999	85.0%	25.0%	NA	
2002	105.0%	60.0%	NA	The concept of Popular Cigarettes was eliminated and a process to gradually standardize both tax rates started. The process came to an end in 2005 with a 110.0% Tax Rate.
2003	107.0%	80.0%	NA	
2004	110.0%	100.0%	NA	
2005 - 2006	110.0%	110.0%	NA	
2007	140.0%	140.0%	NA	
2008	150.0%	NA	NA	
2009	160.0%	NA	NA	
2010	160.0%	NA	.04 pesos per cigarette	
2011 – 2018	160.0%	NA	.35 pesos per cigarette	

Source: Cámara de Diputados del H. Congreso de la Unión (2016b).

meet the technical specifications and security measures so defined by SAT.

Tobacco control law

A new Tobacco Control Law was introduced in June 2008 in order to protect the population against the harmful effects of smoking tobacco, safeguard the rights of non-smokers, and reduce tobacco consumption, among others. Some of the measures approved under this Law were:

- Packs of cigarettes must bear labels stating its health risks, which must cover at least 30% of the front area of the pack, 100% of the back, and 100% of one of its sides.
- Cigarette advertising was banned, unless it is displayed on adult magazines or commercial establishments where minors are not allowed.
- Creation of Smoke-Free Spaces.

2.2 Tobacco tax costs and benefits

An analysis conducted to make an estimation on the optimal tax on tobacco in Mexico shows that, even after 10 years, a former smoker faces a higher risk of getting sick compared to those people who have never smoked in their lives (Cantú, Ricardo, 2013). Therefore, preventive measures must be prioritized. But when a person starts smoking, the policy with the highest – or most efficient – cost-benefit is a price increase via taxes.

This public policy may achieve two goals: 1) higher income for the Government that should be destined to improving the public health system; and 2) consumers change their consumption patterns when the price increases (cigarette consumption is inelastic, but not perfectly inelastic). There is evidence that shows that constant increases on tobacco taxes generate significant gains in the population health, savings in health costs, and reductions in the health system inequalities (Cantú, Ricardo, 2013).

The results from the study conducted by Cantú, Ricardo (2013) showed that the difference between what the tobacco industry contributes to the economy and the cost of externalities generated by the tobacco consumption (e.g. the diseases related to tobacco and productivity loss) is $12,586 Negative Million MXN. In other words, the externalities are greater than the contributions made by the industry to the economy. It also suggests that a specific tax of $22 MXN per pack of cigarettes helps reduce the number of smokers in 10.4% even when this last policy should wait for 10 years until some results are evident).

In China, Verguet et al. (2015)conducted an analysis on the distributive consequences of the financial and health effects of putting a special tax on cigarettes. The study was made by income quintiles in order to assess the impact of the tax on the lowest income population. The methodology used was an extended cost-effectiveness analysis to make an estimation on the gains in health measured in gained life years; the additional income collected through taxes; and the effect on the household expenditure by increasing the cigarette price by 50% as a result of the special tax being fully transferred to the consumers. The study focused solely on the male population as it represents the higher percentage of smokers in the country. The average of tobacco demand price elasticity was of -0.38, which is supposed to vary in -.64 in the quintile of the lowest income, to -0.12 in the quintile of the highest income. The finding was that the lowest income quintile won one third of the 231 Million of Life Years Won during a 50-year life span.

For collection, this increase in 703 Trillion USD, 24% come from the highest income quintile and 14% of the lowest income quintile. On the other hand, the special tax increases the average tobacco expenditure in the household. However, considering only the lowest income quintile, the expenditure decreases. In summary, this policy may be beneficial for the poor as it entails financial and health benefits in the lowest income quintiles.

In México, a study concluded that a 50% price increase in cigarettes translated into 12.8 millions of life years gained, 8,828 millions of dollars in disease costs averted and an aditional tax revenue of 2,900 million dollars (Global Tobacco Economics Consortium, 2018).

Blakely et al. (2015) estimated the impacts on health, inequalities in health services, and the costs incurred and to be incurred by the health system as a result of constant increases on the tobacco tax (10% Year of 2011-2013 vs. a no-increase situation since 2011). This study considered the ethnic inequalities of the disease load related to smoking and Non communicable disease (NCD) in New Zealand. Therefore, 16 smoking-related diseases were concurrently modeled using national data on sex, age, and ethnicity in order to estimate the Quality-Adjusted Life Year (QALYs) and the savings in the health system based on the remaining life years of the population in 2011. The results showed a gain of 260,000 QALYs in 2011 among the groups exposed to tobacco tax increases versus those groups where there was not any increment. The model also showed that there were savings by 2,250 Million USD in costs in the health system. The per capita gains by QALY were 3.7 times more for the Mori (indigenous peoples) vs. those that are not part of the Mori community since the Mori population is more prone to smoking and is more sensitive to the price.

In the Russian Federation, it was found that an increase in tobacco price resulting from tax increases translates into negative variations across all income deciles since the prices also increase in a general fashion (Fuchs, A., Matytsin, M. and Obukhova, O., 2018). In this study for the Russian Federation, considereding the benefits of reducing the medical costs and an increase in working years, the financial effects of an increase in tobacco prices translate into positive and progressive effects.

In Latin American countries, Fuchs and Menses (2017) found that, with a tobacco consumption price elasticity ranging on -0.64 for the lowest income decile to -0.12 for the lowest income decile in Chile, the low income groups may experience positive effects as a result of an increase in tobacco price. This means that taxes may have progressive distributive effects, providing greater benefits among the lowest income groups. Fuchs and Menses (2017) estimated these effects by calculating changes in the income gains coming from the tobacco expenditure, medical expenditure reduction, and life year loss reduction.

2.3 Smoking financial costs

More than 51,000 Mexicans die each year due to smoking-related diseases. This accounts for 76% of all the deaths in Mexico in 2017 (Institute for Health Metrics and Evaluation (Institute for Health Metrics and Evaluation (IHME), 2017), without considering the collateral damages experienced by non-smokers.

> *Smoking causes a negative impact on society by losing life and productive years, as well as the financial burden borne by smokers, their families, healthcare suppliers, insurance companies, and employers (WHO, 2011).*

Epidemiological studies have concluded that smoking cigarettes affects almost every organ in the body (US Department of Health and Human Services (US DHHS), 2004). Measuring these effects in financial terms is a way to assess the direct and indirect costs of smoking.

There are several estimation techniques available based on its perspective, focus or objective (WHO, 2011). For this study, as mentioned in the reference terms, the Fuchs, Matytsin and Obukhova (2018), methodology would be used, which includes two financial effects:

- **Direct effects:** Attributable to Health Costs
- **Indirect effects:** Productivity Loss

Pichon-Riviere A., Bardach A., Augustovski F, Alcaraz A, Reynales-Shigematsu LM, Teixeira Pinto M et al (2016) estimated the direct costs of healthcare services in Mexico.

2.3.1 Direct costs: Health service costs

Seven causes of medical costs attributable to the estimation were included to quantify the financial impact of smoking: heart diseases, chronic obstructive pulmonary disease, second-hand smoking and other causes, lung cancer, other types of cancer, strokes, pneumonia or influenza.

The estimation of direct costs attributable to smoking was obtained from the Financial Impact of Smoking in Latin America. Document of the Instituto de Efectividad Clínica y Sanitaria (IECS) (2013; 2017).

2.3.2 Indirect costs: Productivity loss

Death rate, number of deaths, morbidity, and disease rates are influenced by smoking in two ways: Year Life Loss (YLL) due to an early mortality in the population, and Year Lost Due to Disability (YLD) due to smoking. The productivity cost is related to morbidity, which in turn is listed as an indirect cost. This cost represents the value of the productivity loss resulting from those people that are found to be disabled due to smoking-related diseases. It is estimated by determining the change in the income earned by paid work (WHO, 2019).

In this study, productivity loss is understood as a reduction in active work life years, which are estimated using the YLL.

3 | Methodology

3.1 Elasticity

The elasticities estimation for each decile provides information that allows learning if a tax policy on tobacco consumption translates into progressive or regressive effects. The change in tobacco consumption patterns at households will in turn be obtained via the price elasticity in order to calculate the change in medical expenses as well as the change in work active life years.

The price elasticity of tobacco consumption is estimated via artificial panel data retrieved from the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) using the Deaton model.

The two-part model considers the estimation of two types of sequential elasticities:

1. The prevalence elasticity refers to the prorated change in the smoking prevalence as a result of a proportional change in the cigarette price (smoking probability).

2. The conditional elasticity is the prorated change in the number of smoked cigarettes as a result of a change in the cigarette price (elasticity intensity).

The two-part model allows itemizing the cigarette consumption analysis in: i) using all the ENIGH information about smokers and non-smokers in order to observe how likely is that one of the household members reports having smoked based on the different characteristics of each of the members. In general, this estimation is made through a probit or logit model; ii) analyzing the level of cigarette consumption based on the households showing any tobacco consumption. The elasticity is estimated by an econometric model for continuous variables that fits the data better.

In this case, the probit model of the first stage is defined as follows:

$$\ln yd_i = \beta_0 + \beta_1 price + \beta_3 X_i + \epsilon_i \tag{3.1}$$

Where yd_i is a dichotomic variable where $yd = 1$is any household member that reported having consumed cigarettes, and $yd = 0$ is the opposite. The price refers to the unit value of a pack of cigarettes and X_i is a set of characteristics pertaining to the household and its members.

The second stage is estimated via the methodology developed by John R., Chelwa G., Vulovic V., Chaloupka F (2019), which is based on the almost ideal demand system developed by Deaton and Muellbauer in 1980 (AIDS). This methodology allows controlling the identification problem by using the data from household surveys to estimate elasticities assuming that the prices of the great majority of products in mid and low-income countries vary on a geographical basis.

The geographical variation of price is the result of facing commuting costs and other factors, such as border taxes. Therefore, the commuting costs may be used as an instrumental variable since it is the main factor affecting prices that in turn affect demand.

The Deaton model consists of 6 steps (John R., Chelwa G., Vulovic V., Chaloupka F, 2019):

Deriving the unit values

The unit values are derived from the ENIGH. It is used as a proxy of price and is derived from the following equation:

$$\mathrm{U}_{hc} = \frac{\mathrm{X}_{hc}}{\mathrm{q}_{hc}} \tag{3.2}$$

where x_{hc} is the expenditure on household h located in cluster c, U_{hc} is the unit value on household h located in cluster c and q_{hc} is the quantity on cigarettes on household h located in cluster c.

Testing for spatial variation in unit values

This step consists in checking if the unit values obtained vary spatially. This is done by using Analysis of Variance (ANOVA) to divide the total variation in unit values into within cluster variations and between cluster variations. A significant large F-statistic implies that unit values vary across clusters.

Estimating within cluster regressions

The within clusters regressions of unit values and budget shares are estimated using the following equations:

$$\ln \mathsf{V}_{hc} = \alpha^1 + \beta^1 \ln x_{ic} + \gamma^1 Z_{hc} + \psi \ln \pi_c + \mathsf{u}^1_{hc} \tag{3.3}$$

$$\mathsf{W}_{hc} = \alpha^0 + \beta^0 \ln x_{ic} + \gamma^0 Z_{hc} + \theta \ln \pi_c + (\mathsf{f}_c + \mathsf{u}^0_{hc}) \tag{3.4}$$

where lnV_{hc} is the log of the unit value for household h in cluster c, w_{hc} represents the share of tobacco expenditure in total household expenditure for household h in cluster c and lnx_{hc} is the log of total household expenditure over the relevant reference period. Z_{hc} is a vector of household especific characteristics, f_c is a cluster fixed effect and treated as an error in addition to the error term u^0_{hc} while u^1_{hc} is the standard regression error term.

Obtaining cluster level demand and unit values

$$\hat{\mathsf{y}}^1_c = \alpha^0 + \beta^0 \ln x_{ic} + \gamma^0 Z_{hc} + \theta \ln \pi_c + (\mathsf{f}_c + \mathsf{u}^0_{hc}) \tag{3.5}$$

3.2 Optimal tax

The optimal tax is the tax rate where the income earned by special tobacco tax is equal to the cost attributable to tobacco consumption. For this reason, the costs are broken down into two:

1. **Health costs:** These are the costs related to health-related expenses attributable to tobacco consumption-related diseases.

2. **Productivity loss:** These are the costs related to the productivity loss in the work space due to early deaths or smoking consumption-related disabilities.

To estimate the optimal tax, a reverse engineering exercise was conducted by following the next steps:

1. Obtaining the market share of different cigarette brands.
2. Obtaining the average retail price of 6 brands with the highest market share, and the average retail price of all the other brands.
3. With the information from the first two steps, the average weighed price of a pack of cigarettes is calculated.
4. VAT of the value obtained from the previous step is deduced.
5. The retail markup is deduced from the value obtained from previous steps.
6. The excise tax is deduced from the values obtained during the previous steps.
7. Once the itemized information was obtained during the previous steps, it is possible to obtain the earnings coming from the special tobacco tax using sale data.
8. Using the elasticity calculated in this document, the change in the tax necessary to collect the needed income to cover the cigarette consumption-related costs was estimated.

3.3 Extended cost benefir analysis

By following the methodology of Fuchs, A., Matytsin, M. and Obukhova, O. (2018), this research estimate the tobacco consumption price elasticity by income groups in order to analyze the impact of increasing tobacco taxes.

Based on the elasticity, the following equations measure the change in tobacco expenditure (2); changes in medical expenses (3), and an increase in the work active life years. All of them use the elasticity for the change in the tobacco expenditure estimations.

$$\Delta\text{Expenditure}_{ij} = ((1+\Delta P)(1+\varepsilon_j * \Delta P)-1) * w_{ij0} / \text{Total expenditure}_{j0} \tag{3.6}$$

Where P is the price change, E_{ij} is the price elasticity per decile j, and $w_{ij0}$is the expenditure ratio of the households destined to tobacco consumption in the period 0. The change in household tobacco expenditure per decile is presented as the total and average expenditure ratio per decile in order to quantify the general impact.

$$\Delta\text{Medical expenses}_{ij} = \frac{((1+\varepsilon_j * \Delta P)-1) * \text{Disease cost}_i}{\text{Total expenditure}_{j0}} \tag{3.7}$$

Where the cost of treating tobacco-related diseases per each income decile *i*, is obtained from administrative data from the health sector. The cost of medical expenses incurred due to tobacco-related diseases is distributed via income deciles *i*, based on the ratio of tobacco-consuming households per decile *i*. Therefore, this equation shows the income earnings related to medical expense reductions resulting from a reduction of tobacco consumption in the long term.

$$\text{Work life years}_i = (YLL * \text{Number of smokers}_1)/\text{Population}_1 \tag{3.8}$$

To estimate the increase of work life years is, the life year loss resulting from the tobacco-related diseases *i*, is distributed among the deciles based on the number of households consuming tobacco in each decile. In this way, it is possible to estimate the changes in income per decile.

4 | Data

The data used to estimate the optimal tax, the elasticity, costs and benefits of an increase in the tobacco price can be found next.

- **Health costs:** The calculations were based on IECS (2013).
- **Productivity loss:** The data was retrieved from the Comisión Federal de Mejora Regulatoria (2012), less the inflation effect..
- **Market share:**The market share of each tobacco brand was calculated based on the data retrieved from the Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco 2017 (Instituto Nacional de Salúd Pública, 2017).
- **Retail price:** The retail price of each cigarette brand is the average price reported by the Instituto Nacional de Estadística y Geografía (INEGI) to calculate inflation for July 2018 as part of the most recent data (Instituto Nacional de Estadística y Geografía, 2018a).
- **Retail margin:** Own estimations based on Waters, H., Sànchez de Miera,B., Ross,H., Reynales Shigematsu, L.M. (2010) calculated at the PAHO Workshop in DC.
- **Cigarette sales:** The data corresponding to the sales reported in the monthly manufacturing industry survey for 2018 (Instituto Nacional de Estadística y Geografía, 2018b), less exports, plus imports, reported by the Mexican Ministry of Economy for the same year (Secretaría de Economia, 2018).

- **Household data:** Using data from the ENIGH, an artificial data panel was created from information of the 2008-2018 period. The ENIGH is a survey conducted every two years for different samples. To build an artificial data panel, it is necessary to use a time steady variable to obtain unique groups that may be matched across the different rounds of the survey. Therefore, the Date of Birth variable was used to get a 455-observation panel. Likewise, data from the 2016 and 2018 versions of the ENIGH were used to make an estimate of the elasticity-price in two stages. In this case, the complete samples were used and the 2016 data were updated with the 2018 prices with inflation.
- **YLL** are calculated by using the Longest Possible Individual Life Expectancy less the Age of Death (IHME, 2019).

5 | Results

5.1 Elasticity

The estimations of equation XXXXXX gave the results shown on table 5.1.

The results obtained are similar to those found by Ross et al. (2008) and Jimenez-Ruiz et al. (2008). However, this new estimations solve the endogeneity and selection problems identified by the authors because the surveys do not include the cigarette prices. The methodology developed by Fuchs, A., Matytsin, M. and Obukhova, O. (2018) uses only the households or individuals reporting to have consumed tobacco.

Both, the first and second stage, are estimated for the total sample of households from 2016 and 2018. The prevalence and conditional average elasticity-price is obtained for all the population and for three income groups.

As evidenced, the elasticity is higher, in an absolute value, for the group of households with low incomes. This means that these are more sensitive to the increase in cigarette prices via taxes, eventually ceasing to consume cigarettes. Additionally, the households

Table 5.1. Elasticity by income group 2018

	Price elasticity first stage	Price elasticity second stage	Total price elasticiy
Average	-0.00014	-0.4239	-0.4240
Income group 1	-0.00046	-0.5863	-0.5868
Income group 2	-0.00015	-0.5415	-0.5416
Income group 3	0.00011	-0.4665	-0.4663

Table 5.2. Status Quo

Concept	Pesos
Retail price before IEPS	11.37
IEPS per pack of cigarettes	25.19
Retail price after IEPS	36.56
Retail markup per pack	5.48
Retail price before VAT	42.04
VAT per pack	6.73
Retail price	48.77
Sales (millions of packs)	1,890
IEPS revenue (millions)	47,611.0
VAT revenue (millions)	12,714.2
Total revenue (millions)	60,325.3
IEPS as % of price	51.7 %
Total tax as % of price	65.5%

with the highest income have a lower elasticity and thus, less sensible to changes in tobacco prices.

5.2 Status quo: Optimal price

The status quo estimations – i.e. a 160% ad valorem rate as well as a specific 0.35 MXN tax per cigarette – generate income of 47,611 Million MXN. This figure is greater than 12.1% of the income reported by the Secretaría de Hacienda y Crédito Público (SHCP) in 2018.

The sales obtained from the Encuesta Mensual de la Industria Manufacturera (EMIM) and the *Secretaría de Economía* are 1,890 million of packages of cigarettes in 2018. The weighted average price per pack of cigarette is of 48.77 MXN. Tax burden including VAT and IEPS is in turn 65.5% of the final price, as shown in table 5.2.

Table 5.3. Baseline descriptive results

	General	Group 1	Group 2	Group 3
Total monthly expenditure	31,913	10,912	24,169	60,659
Tobacco consuming households	5.34%	3.39%	5.20%	7.42%
Cigarette expense	0.20%	0.22%	0.20%	0.18%
Portion of medical expenditure for smoking	7.21%	13.45%	9.28%	5.27%
Income lost: Work years	0.19%	0.08%	0.02%	0.01%

Quarterly information

5.2.1 Cost-benefit analysis

To conduct the cost-benefit analysis of an increase in the price of tobacco, several simulations would take place. However, given that the elasticities of the three income groups for 2018 will be used, table 5.3 shows the descriptive results of the baseline scenario about the total expenditure, tobacco expenditure percentage, medical expenses percentage, and life year loss income loss.

Based on the information shown in ENIGH, the households in Mexico have an average quarterly expenditure of $31,913 MXN. The first income group spends $10,912 MXN, the second income group spends $24,169 MXN while the third income group spends $60,659 MXN. The third income group spends 5.5 times more than the first one.

The number of smoking households concentrates in the third income group, but the cigarette expenditure as a percentage of the total expenditure is slightly higher in the first income group. Additionally, the households with less income spend more in tobacco consumption-related medical services – 13.45% vs. 5.26% spent by the households with the highest income.

The income loss resulting from life year loss affects more low-income households since these households lose 0.08% of their income as a result of work disabilities and tobacco consumption-related diseases. The loss among the highest income groups is just 0.01%.

Table 5.4. Impuesto Óptimo

Concepto	Status Quo	Impuesto Óptimo	Variación
Precio al minorista antes del IEPS	11.37	11.37	0.00%
IEPS por cajetilla de cigarros	25.19	55.19	119.09%
Precio al minorista después del IEPS	36.56	66.56	82.06%
Margen del minorista por cajetilla	5.48	9.98	82.06%
Precio al minorista sin IVA	42.04	76.54	82.06%
IVA por cajetilla	6.73	12.25	82.06%
Precio final	48.77	88.79	82.06%
Elasticidad	NA	-0.42	NA
Ventas (millones de cajetillas)	1,890	1,226	-35.13%
Ingresos por IEPS (millones)	47,611.01	67,661.79	42.11%
Ingresos por IVA (millones)	12,714.24	14,633.38	15.09%
Ingresos totales (millones)	60,325.25	82,295.17	36.42%
IEPS como % del precio	51.65%	62.16%	20.34%
Impuestos totales como % del precio	65.50%	75.95%	15.96%

5.3 Simulations: Optimal tax

As described in section 2.3,the smoking costs may be divided in direct and indirect costs. The direct costs refer to health costs resulting from smoking-related diseases. While indirect costs refer to a loss in productivity that is measured by the loss of work years due to disabilities suffered by people contracting tobacco-consumption diseases.

The direct cost estimations for 2018 are 79,991 Million MXN while the indirect costs account for 11,025 Million MXN[2]. This translates into a total cost of 91,026 Million MXN.

An optimal tax is defined as the tax rate needed for the income coming from IEPS to cover both direct and indirect costs.

To prevent a tax increase from turning into a change in the consumption of more affordable brands, only the specific component of IEPS is changed, leaving the ad valorem component at 160%. The estimation results are shown in table 5.4.

The results shown that the maximum possible collection of IEPS for cigarettes account for 67,662 Million MXN. This amount is insufficient to cover the direct and indirect costs, which are 91,026 Million MXN. Based solely on the IEPS, collection, 23,364 Million

[2] Data retrieved from Cantú, Ricardo (2013) minus inflation.

Table 5.5. Elasticities by income group 2018

	Average	Group 1	Group 2	Group 3
Low elasticity	-0.353	-0.489	-0.451	-0.389
Medium elasticity	-0.424	-0.587	-0.542	-0.466
High elasticity	-0.509	-0.704	-0.649	-0.560

MXN are missing to cover such costs. When considering the total collection – i.e. IEPS plus VAT– 8,349 Million MXN would still be missing. This simulation was created with a 160% ad valorem component and a specific component of 1.85 MXN per cigarette. If the specific component keeps on increasing, the collection experiences a decrease since the collection loss caused by the sale reduction is, as of this point, higher than the collection increase resulting from the increasing taxes.

The increase in the specific IEPS component results in a tax burden increase, moving from 65.44% to 75.95% of the total price. This increase translates in a 35.15% sales reduction. Moreover, there is an income increase coming from IEPS which accounts for 42.11% while the income coming from VAT is 15.09%. The total effect over collection is an increase of 36.42%. In the end, the final price experiences an increase of 82.06%.

5.3.1 Cost-benefit analysis

In this sub-section of the report, the distribution effects are calculated based on the equations 3.2- change in the tobacco expenditure; 3.3- change in medical costs; and 3.4- change in life years, plus the data shown in table 5.5.The mean elasticity is the result from the estimation of elasticity-price in two stages as shown in table 5.1. The low and high elasticity levels are the result of reducing or increasing the value of the medium elasticity by 20%.

The results from this estimation will be used to obtain the aggregated effect of a tax policy on tobacco, which will be estimated as follows:

Effect on Income = Change in Tobacco Expenditure + Reduction in Medical Expenses + Income Increase

Two scenarios will be presented in this document:

1. An increase in the cigarette price to arrive at 74% of tax coverage, adding two taxes: VAT and the excise tax. With this structure, a 58% price increase is required to reach the 74% tax coverage[3]
2. An increase in tobacco price that updates the tax based on inflation. This means an 8% increase in the price of tobacco.

Both scenarios are calculated for all three ranges of elasticity and income groups.

5.3.1.1 Direct effect on the price due to tax increase

The changes in cigarette expenditure is calculated based on equation 3.2 and table 5.5. The results are shown in figure 5.1, where it is possible to see that in the first scenario with the upper elasticity level, the first income group may experience a positive effect on its income via an increase in cigarette price. This happens given the 58% increase would cause the lowest income households to reduce their tobacco expenditure by increasing their available income – creating a progressive effect.

For groups two and three, the direct price effects when taxes are increased are negative. This means that even a 58% increase does not foster the households that are part of these income groups to reduce their cigarette consumption.

In the second scenario, the effects resulting from the price increase are negative for all elasticity ranges and all income groups. But these are more negative for higher income households.

5.3.1.2 Medical expenses

The results for medical expenses are shown in figure 5.2.The calculations result from equation 3.3 and table 5.5. The results show that for the first scenario, there is a reduction in medical expenses and an increase in gains coming from the earnings across all groups,

[3] This percentage structure was obtained from the simulation exercise conducted in the PAHO Workshop.

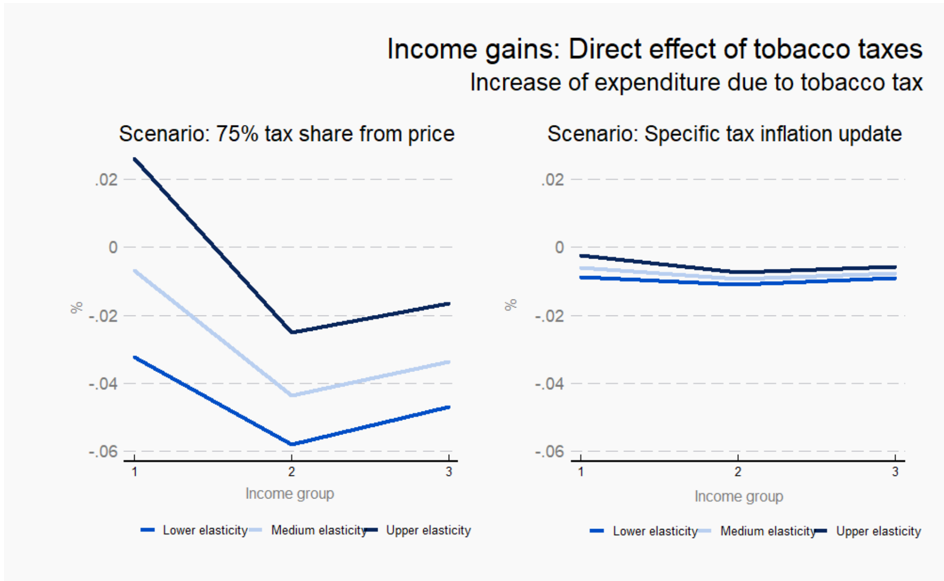

Figure 5.1. Income earnings: Tobacco expenditure reduction

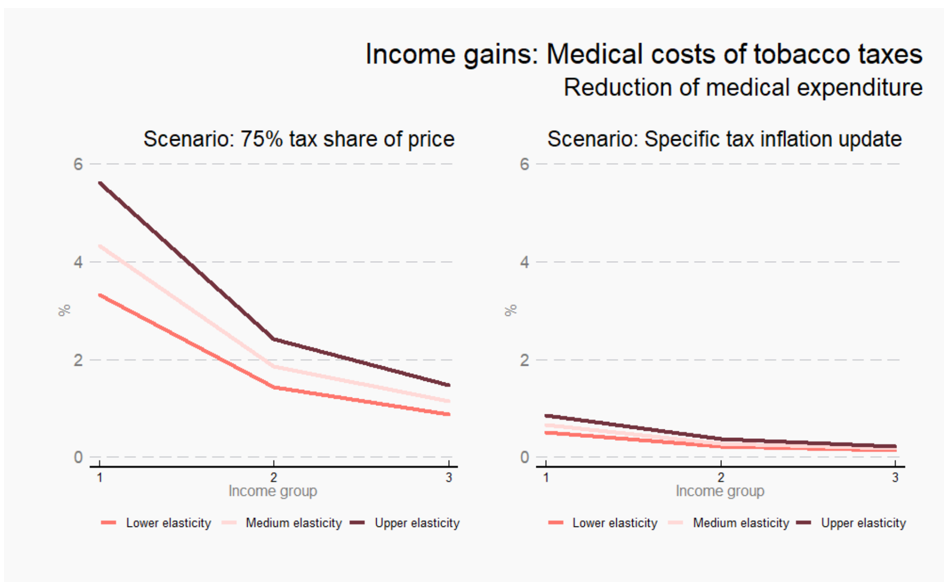

Figure 5.2. Income earnings: Medical expenditure reduction

especially in low income households. Additionally, the changes in medical expenses are greater when the higher limit elasticity is used.

The effect in the second scenario is also progressive since big reductions in medical expenses take place in the group one households, albeit at a lower scale, since the price increase was of 8%.

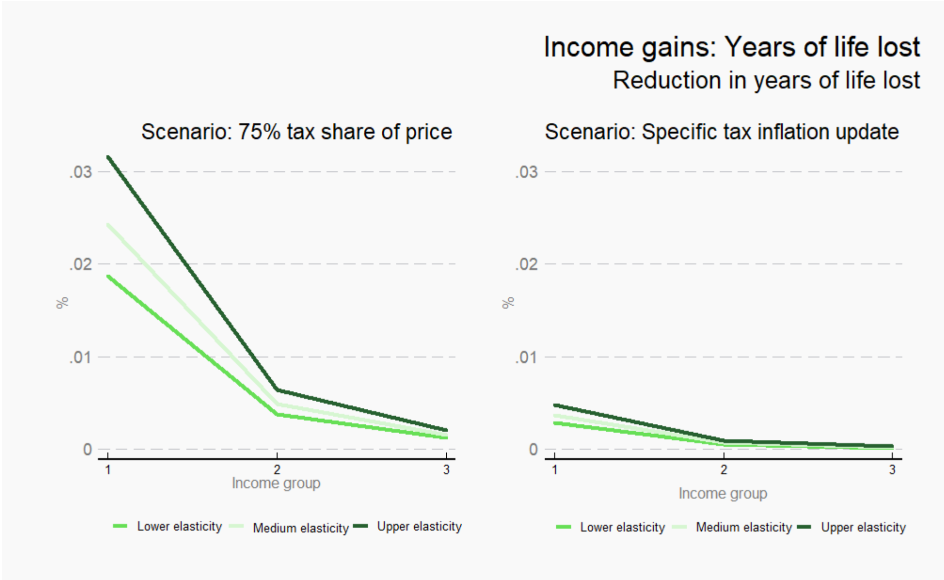

Figure 5.3. Income earnings: Life years lost

5.3.1.3 More work life years

The cost of lost work life due to tobacco consumption was estimated using equation 3.4 and table 5.5. The results shown in figure 5.3, show that a reduction in tobacco consumption and the expected reduction in the lost work years have positive effects in welfare and earnings.

Once again, the effects in the first scenario experienced by the low-income group are higher than those experienced by the other two groups. In both scenarios, however, the effect seems to be progressive.

5.3.1.4 Net effect: Impacts on total distribution

This Sub-Section adds the previous results of changes in tobacco expenditure, medical expenses, and work life years. Using the middle elasticity limit, figure 5.4 shows how the net effect would be better for lower income households than for households spending 5.5 more on a quarterly basis. This means that increasing tobacco prices in any way would be a progressive policy. Indeed, the impacts would be far greater if the price increase was of 58% instead of 8%, as shown in the simulated scenarios.

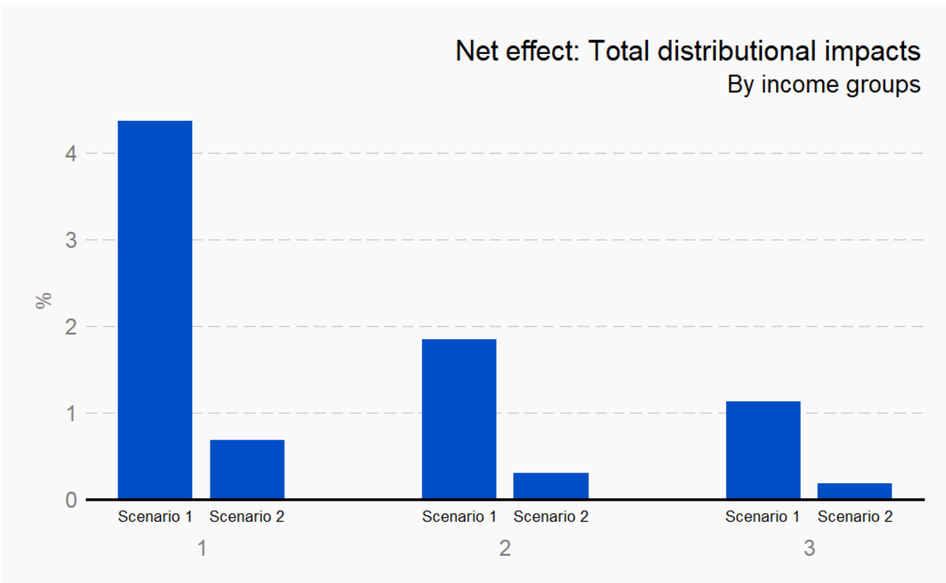

Figure 5.4. Net effects: Total distributive impacts

6 | Conclusions

Literature on Tobacco has shown that smoking causes a negative effect on health and welfare in general. It has also shown that one of the most effective policies to reduce tobacco consumption is to increase tobacco price and taxes. Tobacco consumption is inelastic, however, which means that an increase in price does not translate into a consumption reduction in either one of them. This is the reason why the net effects of a tobacco price increase policy are not clear.

This report attempts to shed some light on this problem by thoroughly analyzing the cost-benefit ratio for two types of tobacco price increase policies. The estimations fully depend on the elasticity used, which will determine how sizeable the impact will be on income as well as the increasing benefits.

Tobacco taxes have two main objectives in mind: One is discouraging tobacco consumption as to improve health and welfare while the second is collecting more money for the public sector, ideally to cover the externalities produced by consuming tobacco.

On one side, the results indicate that the increase in tobacco taxes in Mexico accomplished the first objective by making people stop buying cigarettes or preventing new smokers from arising. This can be inferred since there is a decrease in tobacco consumption among the low-income households when tobacco price increased by 58%. But this is also because there are decreases in medical expenditure across all income groups and elasticity levels.

On the other hand, tobacco taxes represent a source of income of $47,611 Million MXN. This amount must at least cover the direct costs of tobacco consumption, which account for $79,991 Million MXN. The maximum tax amount that the Government would be able to collect from cigarettes is, however, 76%. This means an 82% increase over the final price, with which IEPS income would reach a maximum amount of $67,662 Million MXN. In face of higher tax increases, the effect that the consumption reduction would entail in tax collection is higher than the effect the tax increase has. This is the reason why it is not possible to obtain a tax rate that covers all direct and indirect costs.

Based on the results obtained for Mexico, it is necessary to increase tobacco prices since this policy is **progressive** in nature. Although two thirds of the population would experience increases in tobacco expenses, the benefits are greater in the medical expense reduction, which compensate any negative effect resulting from an increase in the tobacco expenditure percentage across all income groups and elasticity levels.

Acrónimos

EMIM Encuesta Mensual de la Industria Manufacturera

ENCODAT Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco

ENIGH Encuesta Nacional de Ingresos y Gastos de los Hogares

IECS Instituto de Efectividad Clínica y Sanitaria

IEPS Impuesto Especial a Producción y Servicios

IHME Institute for Health Metrics and Evaluation

INEGI Instituto Nacional de Estadística y Geografía

LIEPS Ley del Impuesto Especial sobre Producción y Servicios

NCD Non communicable disease

SAT Sistema de Administración Tributaria

SHCP Secretaría de Hacienda y Crédito Público

VAT Value Added Tax

WHO World Health Organization

YLD Year Lost Due to Disability

YLL Year Life Loss

Bibliography

IECS (2013). Carga de Enfermedades Atribuibles al Tabaquismo en México. *Documento Técnico*, 10.

IECS (2017). El tabaquismo en México. Disponible en www.iecs.org.ar/tabaco.

IHME (2017). Global Burden of Disease, Compare. Disponible en https://vizhub.healthdata.org/gbd-compare/.

IHME (2019). Measuring what matters. Disponible en http://www.healthdata.org/gbd/faq#What%20is%20a%20YLL?.

WHO (2011). Assessment of the Economic Costs of Smoking. Disponible en https://apps.who.int/iris/handle/10665/44596.

WHO (2019). Metrics: Disability-Adjusted Life Year (DALY). Disponible en https://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/.

Blakely, T., Cobiac, L. J., Cleghorn, C. L., Pearson, A. L., van der Deen, F. S., Kvizhinadze, G., Nghiem, N., McLeod, M., and Wilson, N. (2015). Health, health inequality, and cost impacts of annual increases in tobacco tax: multistate life table modeling in new zealand. *PLoS medicine*, 12(7):e1001856.

Cantú, Ricardo (2013). An Optimal Tobacco Tax. *Global Development Network*.

Comisión Federal de Mejora Regulatoria (2012). Tabaquismo en México: análisis y recomendaciones de mejora regulatoria. Disponible en https://www.cofemer.gob.mx/Varios/Adjuntos/14.05.2012/IAPA_COFEMER_TABAQUISMO_EN_MEXICO_2012.pdf.

Cámara de Diputados del H. Congreso de la Unión (2016a). Ley del Impuesto al Valor Agregado. Disponible en http://www.diputados.gob.mx/LeyesBiblio/pdf/77_301116.pdf.

Cámara de Diputados del H. Congreso de la Unión (2016b). Ley del Impuesto Especial sobre Producción y Servicios. Disponible en http://www.diputados.gob.mx/LeyesBiblio/ref/lieps.htm.

Fuchs, A. and Meneses, F. (2017). *Are tobacco taxes really regressive? Evidence from Chile*. World Bank.

Fuchs, A., Matytsin, M. and Obukhova, O. (2018). Tobacco Taxation Incidence. Evidence from the Russian Federation. Disponible en http://documents.worldbank.org/curated/en/691831540997110202/Tobacco-Taxation-Incidence-Evidence-from-the-Russian-Federation.

Global Tobacco Economics Consortium (2018). The health, poverty, and financial consequences of a cigarette price increase among 500 million male smokers in 13 middle income countries: compartmental model study. Disponible en https://www.bmj.com/content/bmj/361/bmj.k1162.full.pdf.

Instituto Nacional de Estadística y Geografía (2018a). Consulta de Precios Promedio. Disponible en https://www.inegi.org.mx/app/preciospromedio/.

Instituto Nacional de Estadística y Geografía (2018b). Encuesta Mensual de la Industria Manufacturera. Disponible en https://www.inegi.org.mx/programas/emim/2007/.

Instituto Nacional de Salúd Pública (2017). Encuesta Nacional de Consumo de Drogas, Alcohol y Tabaco 2017. Disponible en https://encuestas.insp.mx/ena/.

Jimenez-Ruiz, J., De Miera, B. S., Reynales-Shigematsu, L. M., Waters, H. R., and Hernández-Ávila, M. (2008). The impact of taxation on tobacco consumption in mexico. *Tobacco control*, 17(2):105–110.

John R., Chelwa G., Vulovic V., Chaloupka F (2019). A Toolkit on Using Household Expenditure Surveys for Research in the Economics of Tobacco Control. Disponible en https://tobacconomics.org/wp-content/uploads/2019/03/UIC_HES-Tool-Kit_Eng_final.pdf.

Pichon-Riviere A., Bardach A., Augustovski F, Alcaraz A, Reynales-Shigematsu LM, Teixeira Pinto M et al (2016). Impacto económico del tabaquismo en los sistemas de salud de América Latina: un estudio en siete países y su extrapolación a nivel regional. *Panam Salud Pública*, 40(4).

Ross, H., Waters, H., de Miera, B. S., and Shigematsu, L. M. R. (2008). La economía del tabaco y los impuestos al tabaco en méxico.

SE (2018). Sistema de información arancelaria via internet. Disponible en http://www.economia-snci.gob.mx/. Información obtenida el día 18 de septiembre de 2019.

Secretaría de Economia (2018). Sistema de Información Arancelaria vía Internet. Disponible en http://www.economia-snci.gob.mx/.

SSa (2015). Encuesta Global de Tabaquismo en Adultos México 2015. Disponible en https://www.gob.mx/cms/uploads/attachment/file/239090/ENCUESTA_GATS_2015_Resumen_ejecutivo.pdf.

US Department of Health and Human Services (US DHHS) (2004). The Health Consequences of Smoking: A Report of the Surgeon General. Disponible en https://www.ncbi.nlm.nih.gov/pubmed/20669512.

Verguet, S., Gauvreau, C. L., Mishra, S., MacLennan, M., Murphy, S. M., Brouwer, E. D., Nugent, R. A., Zhao, K., Jha, P., and Jamison, D. T. (2015). The consequences of tobacco tax on household health and finances in rich and poor smokers in china: an extended cost-effectiveness analysis. *The Lancet Global Health*, 3(4):e206–e216.

Waters, H., Sànchez de Miera,B., Ross,H., Reynales Shigematsu, L.M. (2010). La economìa del tabaco y los impuestos al tabaco. Disponible en https://www.who.int/fctc/reporting/party_reports/mexico_annex2_economy_of_tobacco_and_taxes_in_mexico.pdf.

WHO (2014). Tobacco Free Initiative (TFI). Disponible en https://www.who.int/tobacco/economics/taxation/en/.

WHO (2019). WHO report on the global tobacco epidemic, 2019. Disponible en https://www.who.int/tobacco/global_report/en/.

Extended cost - benefit **analysis of tobacco consumption in Mexico**