Incidence of Tobacco Taxation in Argentina: Employment and economy-wide effects♣

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Key Messages

- **Increases in tobacco taxation reduce the consumption of tobacco products and improve health outcomes. Substantial increases in tobacco taxes can even increase aggregate employment in the medium term.** The results from CEDLAS's computable general equilibrium (CGE) model for Argentina show that a simulated substantial increase in tobacco taxation induces a zero-net change in overall employment in the economy. Increased tobacco taxes may shift jobs from tobacco-related sectors to other sectors of the economy, but the overall impact on the total number of jobs is negligible.
- **Governments can mitigate and even reverse any adverse employment effects of increased tobacco taxes by devoting the additional tax revenue to increase expenditure on social services and infrastructure.** This study indicates that any negative effects on sectoral employment are greatly reduced or even offset when the government uses the additional tax resources to increase spending on labor-intensive sectors such as education, health, and productive public investment.
- **The overall positive effects of increases in tobacco taxation can be partially allocated to accompanying policies to ease the transition to other activities of those negatively affected by these measures.** Such policies include the implementation and extension of rural development programs to cover farmers' transition costs, training for displaced workers in alternative sectors, a re-direction of newly raised (or existing) tax revenues to alternative crops through agriculture extension services, and other forms of industrial production. An evaluation of where to allocate the new raised tax revenues most effectively is essential. All these programs can help generate a beneficial transition to economically sustainable alternatives to tobacco farming and production of tobacco products. The ultimate purpose of this measures is the long run positive economic consequences stemming from the improvements in health and the environment.

Executive Summary

Since 2016, Argentina has undergone several reforms to increase the tax burden on tobacco products. Tobacco taxation has increased in line with WHO recommendations, with positive distributive effects and other desirable outcomes (see CEDLAS, 2020). Critics of these measures routinely invoke potential negative effects on employment. In this study CEDLAS analyzes the employment effects of increasing tobacco taxation in Argentina by building a computable general equilibrium model (CGE) of the Argentine economy. In line with recent changes in tobacco taxation in Argentina, the CGE model simulates a substantial 15 percentage points increase in commodity tax on tobacco products (cigarettes). The results of the CGE analysis show that even a substantial increase in tobacco taxation in Argentina induces a zero-net change on overall employment in the economy when the newly raised tax revenues are spent by the government on education, health, or public infrastructure. For instance, if the government invests the new tax revenue in public investment spending, estimates show a net employment increase of 787 jobs in 2025 (from about 20.5 million employed individuals in the baseline year 2020). In the worst-case scenario, when the government invests the additional revenue in less-productive sectors, the model yields an estimate of a negligible net decline in total employment of about 0.03 percent (7,500 jobs) in 2025. Increased tobacco taxes may shift jobs from tobacco-related sectors to other sectors of the economy, but the overall impact on the total number of jobs is negligible.

To conclude, this study's results show that the widely documented positive effects of higher tobacco taxes (including a healthier population, more productive workers, savings from avoided costs of medical treatment for tobacco-related diseases, reductions in the number of new young smokers, among others) will far outweigh the nearly null effect of higher taxes on total net employment. The positive impacts of tobacco taxation can be accompanied by other policies to ease the transition: the implementation of rural development programs to cover farmers' transition costs, training for displaced workers in alternative sectors, a re-direction of newly raised (or existing) tax revenues to alternative crops through agriculture extension services and other forms of industrial production. An effective evaluation of where to allocate the newly raised tax revenues is also a key aspect.

1. Introduction

Tobacco consumption imposes many different types of societal costs (including health, and labor productivity). To reduce these harms, governments all around the world implement tobacco control measures. The most effective and cost-effective policy is to increase tobacco taxes. Through higher taxes, governments discourage tobacco consumption and promote a healthier and more productive population. Along with many other countries, Argentina moved in this direction in recent years, increasing the overall tax burden on cigarettes from 69 percent in 2014 to 76 percent in 2018 (CEDLAS, 2020).

This policy reform in the Argentine tobacco sector, as in many other countries, has been subject to two common objections. The first is that higher cigarette taxes increase income inequities since they are regressive: they tend to fall disproportionately on the poorest households, who allocate a larger share of their income to the purchase of tobacco products. However, this reasoning is based on at least two faulty assumptions: 1) that individuals across the income distribution exhibit the same price elasticity of demand for cigarettes and 2) that shifts in tobacco taxation affect households only through changes in their expenditure on the tobacco products themselves. In a recent policy report, CEDLAS (2020) shows that these assumptions do not hold for the Argentinean case. In particular, results show that sensitivities to changes in cigarette prices differ significantly between individuals. Poorer smokers present higher price elasticities of demand, in absolute value. A ten percent increase in cigarette prices would thus decrease consumption by 8.5 percent for the poorest smokers (versus 4.4 percent for the richest smokers). In addition, results indicate that when indirect effects (such as lower medical expenses, longer life expectancy, and more time for income-generating activities) are included in the analysis along with the heterogeneity in individual sensitivities to price changes, an increase in tobacco tax is in fact progressive and generates reductions in household spending for all deciles of the income distribution.

The second argument against increases in tobacco taxes is that they may produce detrimental effects on employment in the tobacco sector and in the whole economy, since labor demand in the tobacco industry is a derived demand.[1] While one might logically conclude that the employment effect of taxing a specific sector would be negative, the effect of higher tobacco taxation on overall employment is not obvious since it depends on many things. The effect on employment depends on the reaction of consumers to these higher taxes (that is, their price-elasticity of demand and the substitutability between tobacco products and other goods), the capability of workers to reallocate to other sectors, and what the government does with the additional revenues from increased taxation, among others. For instance, if the reallocation process of workers between sectors is not costly, and the government directs the excess collection of fiscal revenue to highly productive labor-intensive activities, the overall net effect of increased tobacco taxes on employment could in fact be positive.

This research explores the second objection to tobacco taxes for the case of Argentina. For this purpose, the authors build a computable general equilibrium model (CGE) of the Argentine economy focused on the tobacco sector. CGE models are a class of economic models that assess supply-chain effects; macroeconomic aspects; economy-wide equilibrium constraints; and linkages between different sectors and countries due to changes in policy, technology, or other external factors (Jha et al., 2020). In

[1] In economics, derived demand is demand for a factor of production (e.g., labor, capital) or intermediate good that occurs as a result of the demand for another intermediate or final good. In this case, the final good is tobacco products consumption.

the dynamic CGE, and in line with recent changes to the tobacco tax in Argentina, the authors simulate a 15 percentage points increase in commodity tax on tobacco products (cigarettes).[2] The tax is increased in 2021 and remains at this higher level from 2021 to 2025. This increase in commodity tax raises the relative prices of tobacco products and – given the structure of tobacco taxation in Argentina – generates a reduction in consumption of about 12 percent. This reduction in demand is very similar to that observed in official administrative data. This permanent shock in tobacco taxation allows the authors to analyze short- and long-term effects. Additionally, the authors simulate alternatives scenarios in which the newly raised tax revenues return to the economy as higher public expenditure on education, health, or public infrastructure investment.

2. Tobacco Taxation in Argentina

In Argentina, tobacco taxation includes several different taxes, composed as follows:

i) An excise tax (INT) with a rate of 70 percent on the final sale price (PF) excluding the additional emergency tax on tobacco, the tax associated with the special tobacco fund and the value-added tax. This excise tax also has a specific component that must remain higher than a minimum value adjusted by the consumer price index (CPI).[3]
ii) An additional emergency tax (IAE) with a rate of seven percent on the PF.[4]
iii) The tax associated with the special tobacco fund (FET) with a rate of 8.35 percent on the PF excluding the value-added tax (VAT) and the IAE and a fixed updatable amount.[5]
iv) The value-added tax (VAT) with a rate of 21 percent on the PF excluding the IAE, FET, INT, and the gross income tax.
v) The gross income tax, a subnational turnover tax with an implicit rate of 4.77 percent on PF excluding the IAE, FET, INT, and VAT.

Since 2016, the cigarette tax has undergone several reforms. At the beginning of that year, the excise tax (INT) had an ad valorem rate of 60 percent.[6] In May 2016, this internal tax was increased to 75 percent (Decree 626/2016). Finally, in December 2017, an additional reform set a 70 percent rate on the internal tax and established a minimum tax of $28 pesos per pack of 20 sticks.[7] Thus, tobacco

[2] Argentina has modified its tobacco consumption tax scheme in recent years, following the recommendations based on international consensus. At the beginning of 2016, the excise tax on cigarettes had an ad valorem rate of 60 percent. In May 2016, the tax increased to an ad valorem component of 75 percent of the consumer sale price.
[3] Fixed at $28 as of December 2017 and indexed for inflation. Law 24.674.
[4] Law 24.625.
[5] Fixed at $1.7 as of December 2017. Law 19.800. The FET works as a mechanism to correct structural deficiencies and ensure a compensatory price for tobacco producers. 80 percent of the FET is distributed according to the production value to the provinces. These resources are assigned to primary production through direct and indirect contributions (via Annual Operational Projects - POAs). 20 percent of the FET is managed by the Ministry of Agroindustry. The POAs are oriented both to reconversion to other activities and to the improvement of the production and quality of life of the tobacco family producer. Technification processes of the primary stage are also contemplated. The 3.5 per thousand that is charged on the price of cigarettes goes directly to social projects ($297 million in 2018). The price received by the primary producer for the sale of tobacco is made up of two parts: on one hand, the amount paid at the time of collection by the collecting companies; and on the other, the FET price. In 2018, an average of $58.4 per kilo of tobacco was paid. The storage price represented 64 percent of the total price; and the FET price 36 percent. In 2018, the FET price increased by 106 percent and the stock price increased 25 percent. Thus, the average total price registered an increase of 46 percent.
[6] Before the December 2017 reform, there was a minimum ad valorem tax. This could not be less than 75 percent of the corresponding tax (that is, the internal tax with a rate of 60 percent) over the price of the most-sold brand of cigarettes.
[7] This tax is now around $76, but the law does not apply to all tobacco companies due to a judicial interference by small tobacco companies. Beyond the reduction of the ad valorem component, the introduction of the specific component sought

taxation in Argentina has been increasing, in line with World Health Organization (WHO, 2015) recommendations. According to WHO estimates, the total tax burden on tobacco was around 70 percent between 2008 and 2014. After the May 2016 reform, this burden increased to about 80 percent.[8]

According to official administrative data, the average price of a pack of cigarettes in Argentina during the year prior to the May 2016 reform (that is, between April 2015 and April 2016) was $25.8 pesos. During the year after the reform (that is, between June 2016 and June 2017) the average price was $38.6 pesos. This represents an increase of around 49 percent in nominal terms, and around 39 percent when accounting for inflation. Cigarette sales experienced a reduction of around 12 percent. Before the reform, the average amount of monthly sales was around 167 million packs, while after the reform it was around 148 million. Finally, tax revenue from tobacco increased by around 37 percent. Previous to the reform, the average amount of monthly tax collection was around $1.064 billion pesos, while after the reform it was around $1.458 billion pesos.[9] Thus, the increase in tobacco taxation generated the classic economic effects of partial equilibrium analysis: a rise in the price of the taxed product, a decrease in consumption, and an increase in tax collection (CEDLAS, 2020). In this policy report the authors simulate a 15 percentage points increase in commodity tax on tobacco products (cigarettes). This is in line with the observed raise in the ad valorem rate of the internal tobacco tax, in May 2016 (that is, from 60 percent to 75 percent).

3. The Tobacco Sector in Argentina and the Evolution of Employment

3.1. Tobacco's value chain in Argentina[10]

In Argentina, tobacco growing is concentrated in seven provinces: Jujuy (with 36 percent of total production in 2018), Misiones (29 percent), Salta (25 percent), Tucumán (7 percent), Catamarca (1 percent), Corrientes (1 percent), and Chaco (1 percent). The latest available data indicate that in the 2015–2016 harvest, 19,170 producers were registered. Tobacco, both blond and black, is grown in areas with a warm and wet climate and is harvested in the summer season. In relation to other crops, tobacco growing stands out for the high employment requirements and the high productivity in small-scale farms. The production of cigarettes is carried out predominantly outside of the growing area, basically in Greater Buenos Aires (Merlo, Pilar, San Martin, and Avellaneda), Corrientes (Goya), Jujuy (El Carmen), Santa Fe, and Salta.

In 2018, the Gross Production Value (VBP) of tobacco cultivation was $7.065 billion Argentine pesos and represented 0.5 percent of agricultural crops and 0.03 percent of VBP of the total national economy. Primary production is mainly oriented to two types of markets: i) the manufacture of cigarettes for the domestic market (50 percent) and ii) the manufacture of raw tobacco for exports (50

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to leave the tax pressure on tobacco constant. For a discussion on optimal structure of tobacco taxes (that is, ad valorem versus specific) see Petit & Nagy (2016).

[8] Note that total tax burden on cigarettes' final price should be estimated through a 5-equation system and solving for the final price. See Appendix 1 for further details on tax burden estimation.

[9] This includes collection of the excise (internal) tax and the additional emergency tax.

[10] The main data source of this subsection is the Ministry of Economy of Argentina (2019). Specifically, the Under-Secretariat for Microeconomic Programming.
See: https://www.argentina.gob.ar/economia/politicaeconomica/microeconomica/informesproductivos#sectoriales

percent). In the 2006–2018 period, the average production was 125 thousand tons. Between those years, production fell 28 percent. Between 2006 and 2017, the planted area decreased by 24 percent at the same time that the yield increased by 7 percent. In 2018, the varieties harvested were Virginia (61 percent), Burley (36 percent), and Criollas (3 percent).

The provinces of Jujuy and Salta, with a smaller number of producers, are those that make the greatest contribution in terms of production. At the same time, they are the provinces where the highest yields are obtained, and they are predominately medium to large establishments. The rest of the provinces are characterized by family farms with family labor, little capital, and a small, planted area (in general, no more than two hectares).

Despite the technological change that prevails in agriculture, tobacco primary production (i.e., cultivation and harvest) continues to be labor-intensive. In 2017, the planted area reached 60,571 hectares. Based on technical relationships[11] and considering a 180-day tobacco production cycle, for 2017 it was estimated that tobacco production required 23,500 jobs.

Cigarette manufacturing (i.e., industrial stage for tobacco products production) is oriented to the domestic market and is strongly dominated by two of the four leading worldwide companies: Philips Morris (PMI Argentina) and British American Tobacco (BAT), which account for 89 percent of cigarette sales in the country. Both develop different strategies to control all stages of the production process, from the provision of inputs to the final product. In turn, they enter into exclusive contracts for distribution on the wholesale and retail channels. PMI Argentina has vertically integrated production with its own leaf collection centers, while BAT is linked to Alliance One Tobacco, the main tobacco leaf processor in the country. This activity Leaf processing by both companies is carried out mainly in Greater Buenos Aires. The industrial stage (collection and production of cigarettes) comprises 0.7 percent of the total manufacturing industry and 0.2 percent of VBP of the national economy ($40.972 billion Argentine pesos). It is a highly regulated sector.[12]

The Physical Volume Index (IVF) of the production of tobacco products, after having reached its historical maximum in 2012, shows a sustained decline (with the exception of 2014 and 2017) in line with the slowdown in domestic demand in recent years. As previously mentioned, in 2016 changes to the tax structure were made.[13] The IVF fell sharply (-15 percent year over year). After a slight recovery in 2017, this downward trend resumed in 2018 (-8 percent year over year), even outpacing the average industry drop (-5 percent year over year).

Regarding Argentine foreign trade, tobacco leaf exports averaged 328 million US dollars in the period 2006–2018. Since 2014, there has been a downward trend in prices obtained in external sales. In 2018, Salta, Jujuy, and Misiones made 94 percent of external sales. The main exported products are Virginia and Burley. They contributed, on average, 88 percent of external sales between 2006 and 2018.[14]

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[11] The cultivation of tobacco requires on average around 110 daily wages ("jornales") per hectare per year. Depending on the variety, the requirement per hectare changes. While in the case of Virginia 120 wages/hectare/year are estimated, for Burley tobacco 90 wages/ hectare/year are calculated.

[12] See Law 26.687. Also, in 2003, Argentina adhered to the Framework Convention for Tobacco Control (FCTC) of the World Health Organization (WHO) that entered into force in 2005. It focuses on different tobacco control policies, such as the increase in taxes on all products made with tobacco, among others.

[13] The IVF is only for manufactured tobacco products (cigarettes).

[14] Virginia-type tobacco exports averaged 57 percent of the total. For their part, external sales of Burley-type tobacco averaged 31 percent of the total.

The most relevant export destinations are China, Belgium, and Paraguay.[15] Imports averaged $59 million between 2006 and 2018. Since 2012, the trend is downward. The trade balance is positive with an average of $269 million. In 2018, exports registered a decrease of eight percent (year over year), explained by a drop of five percent in quantities and a decrease of three percent in prices. In the 2006–2018 period exported quantities declined 15 percent, however, dollars earned from exports (in current terms) increased 36 percent. The highest implicit export price was obtained in 2014 (US$ 4,994 per ton). Since then, in line with the trend of other commodities, there has been a drop in export prices, but they have remained relatively high.

In 2018, sales of cigarettes were 1.740 billion packs of 20 sticks. The sales peak was reached in 2011 when 2.154 billion packs were sold. In recent years, turnover has grown as a result of price increases while the volume of cigarettes sold has declined. In 2018, turnover grew by 19.4 percent. Small and medium firms concentrated 11 percent of total sales by offering cheap cigarettes, in the price range between $21.50 and $38.13. Large companies (such as BAT, PMI) explain 89 percent of total sales and dominate the highest price range, with a maximum of $88 per pack as of March 2019.

3.2. Employment evolution

To analyze the dynamics of employment in the tobacco sector, the study must define which activities participate in the production (growth), manufacture (cigarettes), and distribution of tobacco products. The authors utilize quarterly employment data, disaggregated at the four-digit level of the International Standard Industrial Classification (ISIC), Revision 3.[16] In this section of the report the authors show the evolution of employment for the four-digit industry 1600 “Manufacture of tobacco products,” given that activities related to the growing of tobacco are reported in these data together with other activities and could distort analyses of the actual evolution of employment in the sector.[17]

The total number of registered workers employed in activities related to tobacco for the year 2018 goes from 5,908 – taking into account the manufacture of tobacco products – to 25,282 also including the growing of tobacco and activities related to the sale of the product. These numbers represent 0.49 percent of total manufacturing employment (5,908 out of 1,212,422 total workers), and 0.38 percent of total employment (25,282 out of 6,604,524 total workers), respectively. To place these percentages in relative terms, for example, the manufacturing industry 1552 “Manufacture of wines” employed 20,868 formal workers during the year 2018, equivalent to 1.72 percent of total manufacturing employment. On the other hand, the teaching sector (8000), employed in 2018 a total of 509,504 formal workers, 7.71 percent of overall formal employment in Argentina.

Figure 1 shows the dynamics of employment comparing tobacco manufacturing to the rest of manufacturing. It is clear that the employment demanded by tobacco activities contracted in the last

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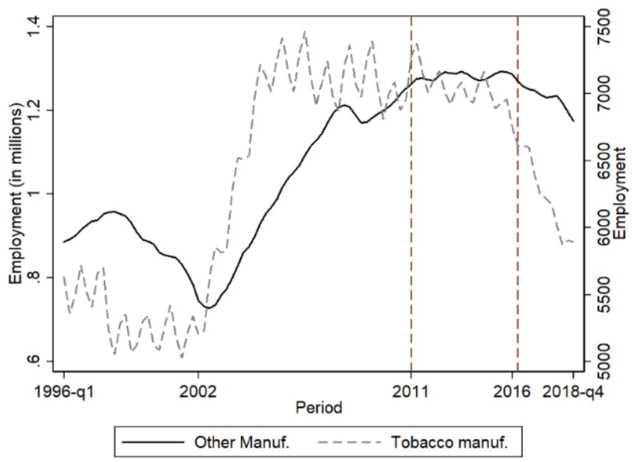
[15] Followed by United States, Germany, Canada, Russia, Uruguay, Brazil, and the Netherlands.

[16] At this level of disaggregation, there are 300 industries belonging to primary, manufacturing, and services activities. For example, the industry 1512 refers to the processing of fish and fish products.

[17] For instance, there are other non-manufacturing industries related with tobacco activities, such as the four-digit industry 5124, “Wholesale of cigarettes and tobacco products”, the industry 5129 “Retail sale of food products n.e.c and tobacco” and the industry 0114 “Growing of industrial crops, spices and aromatic and medicinal plants”. It is worth noting that the last four-digit industries (5129 and 0114) contain a five-digit industry related to tobacco, but also include other five-digit industries that are not tobacco-related.

years, at least in relative terms, when comparing it with other manufacturing industries. Specifically, employment in tobacco activities was contracting before the introduction of the higher tax on cigarettes in May 2016, something that can be easily rationalized given the increase in tobacco control campaigns and the restriction of smoking in closed public spaces, among others. In particular, the year 2011, where the relative employment contraction in the tobacco sector begins, corresponds to the declaration of Law 26687 of tobacco control in Argentina. This law introduced substantial changes, including imposing several restrictions on tobacco use, promotion, and sales.

Figure 1. Evolution of registered employment in Argentina: Tobacco manufacturing versus all other manufacturing, seasonally adjusted (1996–2018)



Note: Employment in millions of registered workers on left axis.
Source: Authors' calculations based on data from the Ministry of Production and Ministry of Labor.

4. General Equilibrium Effects of Tobacco Taxation

4.1. The CGE model

The CGE model used in this study is based on GEM-Core (Cicowiez & Lofgren, 2017), which draws on Lofgren, Cicowiez, et al. (2013) and Lofgren, Harris, et al. (2002). GEM-Core is a computable general equilibrium (CGE) model designed for country-level analysis of medium- and long-term development policies. Technically, the model is made up of a set of simultaneous linear and non-linear equations. It is economy-wide, providing a comprehensive and consistent view of the economy, including linkages between disaggregated production sectors and the incomes they generate, households, the government, and the balance of payments. It is an appropriate tool for analyzing tax changes given the fact that it, in an integrated manner, captures household welfare, government budget, and differences between sectors in terms of household preferences, labor intensity, technological change, links to international trade and the domestic economy, and capital accumulation. In each period, the different agents (producers, households, government, and the nation in its dealings with the outside world) are subject to budget constraints: receipts and spending are fully accounted for and by construction equal (as they are in the real world). The decisions of each agent – for producers and households, the objective is to maximize profits and utility, respectively – are made subject to these budget constraints. For example, households set aside parts of their incomes to direct taxes and savings, allocating what is left to consumption with a utility-maximizing composition. For the nation, the real exchange rate adjusts to ensure that the external accounts are in balance.[18] Wages, rents, and prices play a crucial role by clearing markets for factors and commodities (goods and services). For commodities that are traded internationally (exported and/or imported), domestic prices are influenced by international price developments. Given that Argentina is a small country, it is assumed that international markets demand and supply the country's exports and imports at given world prices. For this application, GEM-Core is modified to allow the assumption that the output of the tobacco leaf sector is exogenous and that exports are determined as a residual once domestic demand is satisfied.[19] Therefore, in case there is an increase in the domestic price of tobacco products (for example, due to higher taxes on cigarettes) the resulting decrease in the domestic demand for tobacco leaf will be compensated one-to-one by an increase in exports of tobacco leaf.

Over time, production growth is determined by growth in factor employment and changes in total factor productivity (TFP). Growth in capital stocks is endogenous, depending on investment and depreciation. For other factors, the growth in employable stocks is exogenous. For labor and natural resources (with sector-specific factors for natural-resource-based sectors), the projected supplies in each time period are exogenous. For natural resources, they are closely linked to production projections. For labor, the projections reflect the evolution of the population in labor force age and labor force participation rates. The unemployment rate for labor is endogenous. TFP growth is made up of two components, one that responds positively to growth in government infrastructure capital stocks and one that, unless otherwise noted, is exogenous.

4.2. Data

The basic accounting structure and much of the underlying data required to implement GEM-Core, like other CGE models, is derived from a Social Accounting Matrix (SAM).[20] Most features of a SAM for GEM-Core are familiar from SAMs used for other models. However, a SAM for GEM-Core has some unconventional features related to the explicit treatment of financial flows.

GEM-Core is calibrated to a 2018 SAM and other data for Argentina.[21] The year 2018 is the latest for which all the required data are available. This study's SAM includes 42 activities/commodities including tobacco by province and tobacco products; 7 factors (3 labor, capital, land, 2 other natural resources); ten representative households (smokers and non-smokers, specialized in different sources of income); and other institutions (enterprises, government, and the rest of the world). Table A2.1 in

[18] In GEM-Core, other options such as adjustments in foreign reserves or borrowing are possible but may not work in the long term.
[19] In this paper the words "tobacco" and "tobacco leaf" are used to refer to the output of the cultivation of tobacco.
[20] A SAM is a square matrix representation of the transactions between productive sectors represented by activities and commodities (or products), households, factors of production (for example labor, capital, and natural resources), government, savings, investment, and the rest of the world for a specific year. For each of these accounts, a cell represents a payment column-wise and a receipt row-wise (that is, a payment from the column of the cell to its row). In turn, due to the accounting consistency of a SAM, the total expenditure of every account must equal its total income. In other words, the total of every row must be equal to the corresponding total of the column.
[21] To build this SAM for Argentina, the authors follow a top-down approach as described in Round (2003) and Reinert & Roland-Holst (1997).

Appendix 2 shows the accounts in the SAM, which determine the disaggregation of the model. For the sake of brevity, all figures and tables in the main text aggregate the SAM data to nine activities and commodities and five factors (that is, labor [3], capital, and natural resources).[22]

The main sources of information for building the SAM are 2018 national accounts data with sectoral disaggregation, international trade (exports and imports), the balance of payments, government data (specifically budget and recurrent incomes and expenditures), and household income and spending data. This information is complemented with the 2004 supply and uses tables, which are the latest available for Argentina. Additionally, a 2018 SAM documented in Michelena (2019) is also used. To enable household-level impacts to be estimated, households are disaggregated using Argentina's Household Income and Expenditure Survey for 2004 and 2005 (ENGHo 2004/2005). Most of the data were obtained from the National Institute on Census and Statistics of Argentina (INDEC). Besides, other sources of information are the Ministry of Economy of Argentina and the IMF Balance of Payments Statistics. Finally, information about the tobacco value chain draws from the Ministry of Production.

Beyond the SAM, data related to factor stocks and various elasticities (production, consumption, and trade) are used to calibrate the model. For capital depreciation rates, the authors follow Agénor et al. (2007) and assume 4.5 percent and 3.5 percent for private and public capital, respectively. For unemployment and underemployment, the authors use CEDLAS's estimates from the Argentina Labor Force Survey (Encuesta Permanente de Hogares EPH). For projections of the population (total and working age), the authors use the 2019 UN World Population Prospects data set. Regarding data specific to the tobacco sector, the authors use information about the gross value of production, value added, and employment described in subsection 3.1.

In addition, the calibration of any CGE model requires the specification of (exogenous) supply and demand elasticities. Specifically, the elasticities define behavior including the degree to which producers can substitute labor with capital, consumers can substitute domestic goods and services with imported ones (the Armington elasticity), producers can substitute domestic sales with exports (the CET elasticity), and households increase their consumption of each good and service when their overall consumption spending increases.

The required (exogenous) elasticities apply to production, trade, consumption, and the labor market. The values, which are be based on Cicowiez (2011), Sadoulet and de Janvry (1995), Dimaranan et al. (2006), and Muhammad et al. (2011) are as follows: the value-added elasticities of substitution are in the range of 0.20–0.95, the Armington and CET elasticities are both in the range of 0.9–2.0, and the own-price elasticities for household consumption demand are in the range 0.4–1. Most importantly, the authors calibrate GEM-Core Argentina under the assumption that the own-price elasticity of tobacco product consumption is 0.6; this value is consistent with econometric estimations reported in CEDLAS (2020). In practice, this means that, under a partial equilibrium assumption, household consumption of tobacco products decreases by 0.6 percent when the price of tobacco products increases by one percent. However, in this study's CGE model, the resulting change in the household consumption of tobacco products also depends on indirect effects such as those derived from the factor markets (see below).

[22] However, all simulations were conducted at the level of sectoral disaggregation showed in Table A2.1 in the Appendix 2.

In any CGE application, the labor/capital ratio of the production sectors plays an important role in the results obtained from policy simulations. Besides, other important ratios are the weight of the sectors in GDP, exports, and imports, the export/output ratio, and the import/total consumption ratio. Figure 2 describes the sectoral structure of Argentina's economy in 2018. Panel A presents value-added distribution by economic sectors. Panel B shows the employment distribution. Exports and imports distributions are shown in Panel C and D, respectively. In all Panels it can be observed that tobacco-related activities (growing or primary production and manufacturing of tobacco products) represent a small share of the Argentinean economy. Figure 3 covers the structure of sectoral factor demand. Labor use intensity in primary tobacco production is approximately 50 percent, while capital intensity is 40 percent. On the other hand, tobacco manufacturing is highly capital intensive (75 percent).[23]

As described in subsection 3.1, regarding tobacco data in GEM-Core Argentina, the Gross Production Value (VBP) of tobacco cultivation in 2018 was $7.065 billion Argentine pesos and the VPB of tobacco products was ($40.972 billion Argentine pesos. Tobacco product consumption in units (sales of 20-stick cigarette packs) was 1.740 billion packs in 2018. Tobacco exports were $3.488 billion for tobacco production and $509 million for tobacco products. Imports were $376 million and $1.092 billion, respectively. Employment in tobacco cultivation was 23,500 jobs and in tobacco manufacturing it was 5,900 jobs.

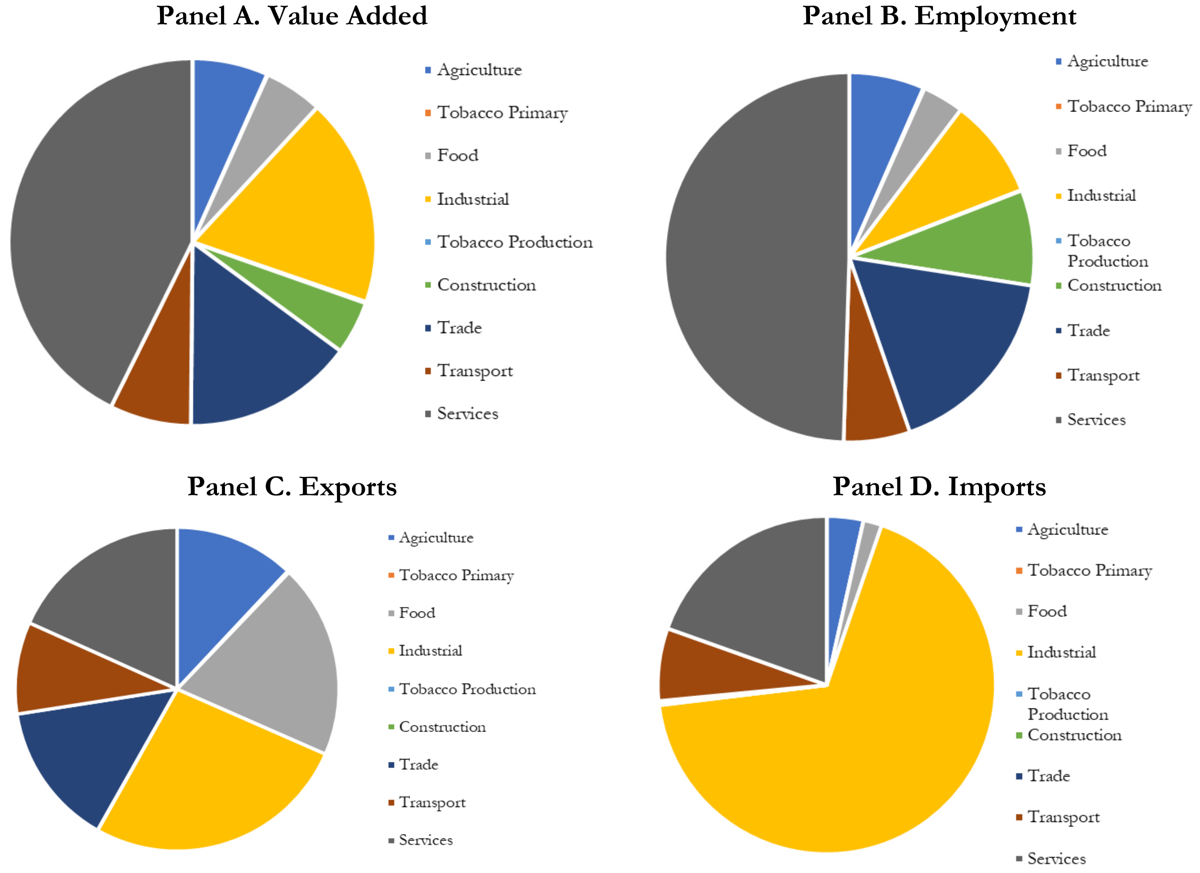
Finally, effective tax rates on commodities, excluding trade taxes, were 5.8 percent of total supply value for tobacco production and 62.6 percent of total supply value for tobacco products (Figure 4).[24] Here, it is important to note that tobacco products initially present a high effective tax burden, which is critical when simulating a tax increase on this commodity, given the relationship between the level of the tax rate and the deadweight burden.[25] By comparison, excise taxes account for about 44 percent of the retail price of cigarettes in the United States (Chaloupka et al., 2017).

[23] Figure A2.1 in Appendix 2, in line with the information presented in Section 3, indicates that half of the total tobacco production value is exported. This share is the highest export intensity between all economic sectors.

[24] It is worth noting that this is not the overall tax burden; this is the ratio between excise tax collection and total supply value (that is, domestic production sold in the domestic market and imports). It is important to show this tax rate because this is what is increased in the simulation below. In order to approximate the observed raise in the ad-valorem rate of the internal tobacco tax in May 2016, this is increased from 62.6 up to 77.6 percent, which represents a substantial increase in tobacco taxation.

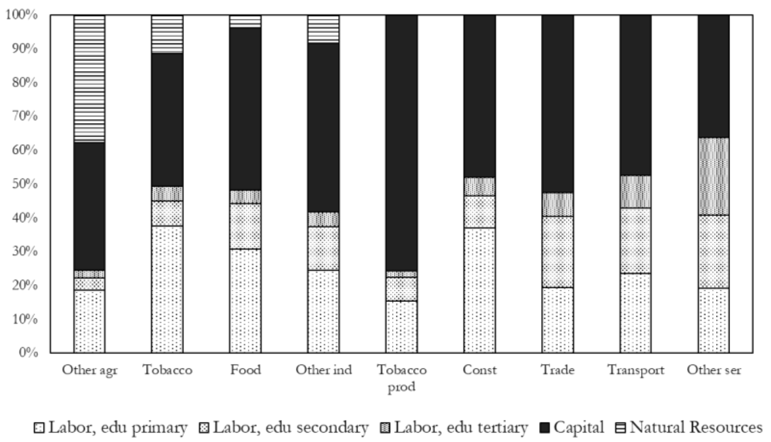
[25] The inefficiency of any tax is determined by the extent to which consumers and producers change their behavior to avoid the tax; deadweight loss is caused by individuals and firms making inefficient consumption and production choices in order to avoid taxation. If there is no change in the quantities consumed, the tax has no efficiency costs. A well-established result in terms of efficiency costs of taxation is that deadweight burden increases with the square of the tax rate: small taxes have relatively small efficiency costs, large taxes have relatively large efficiency costs (Gruber, 2016).

Figure 2. Select information contained in the SAM, by sectoral structure



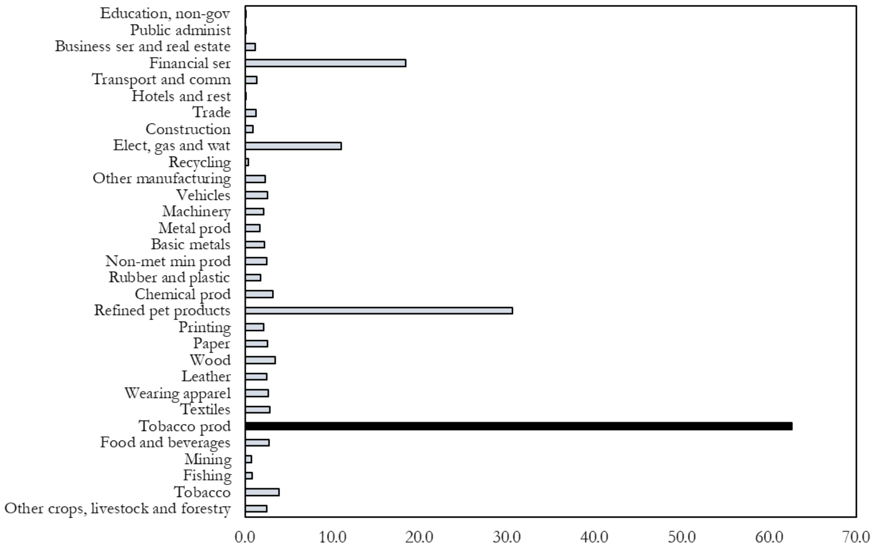
Source: Authors' calculations based on 2018 Argentina SAM

Figure 3. Structure of sectoral factor use, by sectors (2018)



Notes: Food includes fishing.
Source: Authors' calculations based on 2018 Argentina SAM

Figure 4. Tax rates on different commodities, 2018 (%)



Source: Authors' calculations based on 2018 Argentina SAM

4.3. Simulations

The economy-wide analysis is based on the results of a number of scenarios. First is the base scenario, which represents a business-as-usual projection without policy changes and serves as a benchmark for comparisons. It runs from 2018 (this study's base year) to 2025. Under this scenario, the annual growth rates for real GDP at factor cost are exogenous. Specifically, the authors impose the observed growth rates in real GDP at factor cost for the year 2019 and an average growth rate of 2.0 percent during 2020–2025 (see Figure A2.2 in Appendix 2). For 2019, the authors use estimates from the National Institute on Census and Statistics of Argentina (INDEC). For 2020–2025, the growth estimates are based on the IMF World Economic Outlook (WEO-IMF).[26]

Second, the authors consider the effect of an excise tax increase on tobacco products. The study simulates a shock of a 15 percentage points increase on the cigarette tax rate, in line with the observed raise in the ad valorem rate of the tobacco excise tax during May 2016. In this study's simulation, the effective tax rate on tobacco products rises from 62.6 percent to 77.6 percent. The tax is increased in 2021 and remains at the new tax rate from 2021 to 2025. In other words, it is a permanent shock that begins in 2021. Thus, the authors can analyze short- and long-term effects.[27] The authors simulate two alternatives scenarios for the allocation of the newly raised tax revenues:[28]

i) the government increases spending on education and health (Scenario 1), and

[26] The exogenous part of TFP growth is adjusted to generate these growth rates (see Figure A2.2 in Appendix 2). In non-base scenarios, GDP growth is invariably endogenous.

[27] As remarked by Jha et al. (2020), this type of shock is like a pendulum that swings through all markets until it reaches its stationary position again. The swing could normally take 3–5 years to reach a new equilibrium.

[28] Note that the newly raised tax revenues that are reallocated are those that result in total tax collection, considering the general equilibrium mechanisms. That is, those that result in the variation in total tax collection at the country level, and not only what is obtained by the increase in internal taxes on tobacco.

ii) the government increases spending on public infrastructure investment with a high marginal product of capital (Scenario 2).[29]

In the non-base scenarios, the main transmission channels are as follows. In all cases, higher tobacco taxation increases the relative price of tobacco products. Thus, tobacco consumption decreases. As a consequence, production and employment in the tobacco sector also decrease.[30] In the literature, this is sometimes referred to as the gross impact on tobacco employment. In the estimates below, the authors present the net impact on tobacco employment that results once the indirect or general equilibrium effects are also considered. In a sense, the gross impact on employment is akin to a partial equilibrium estimate in as much as it assumes that no other impacts occur through (indirect) changes in the commodity and factor markets. This is the gross impact on employment, where the disposable income that was previously spent on tobacco that would normally be spent on something else and the newly raised tax revenue are not returned to the economy.[31] This would be equivalent to calculating estimates of the employment impact of tax increases by assuming that a job permanently disappears from the economy rather than being reallocated to other sectors. However, consumers can substitute consumption and, through the input-output linkages, other sectors in the economy might be positively affected. That is, demand for other products increases, as do production and employment in those sectors. This is the net impact on employment, where the income previously spent on tobacco and the newly raised tax revenues returns to the economy by allowing consumers and the government to spend them on alternative goods and services according to preexisting spending patterns (Chaloupka et al., 2017). This net impact is reported in the next subsection.

4.4. Results

Table 1 reports simulated changes in key macroeconomic variables within each scenario in response to the tobacco tax increase. The Table compares the base scenario (without tax increase) with two alternative scenarios that include the 15 percentage points increase on the cigarette tax rate. In Scenario 1, the government spends additional revenues on education and health; in Scenario 2, the government spends additional revenue on public infrastructure investment. In addition, the Table also reports short- and long-term effects. Most variables are expressed in real terms, with the exception of

[29] At the macro level, GEM-Core Argentina – like any other CGE model – requires the specification of equilibrating mechanisms ("closures") for three macroeconomic balances: government, savings-investment, and the balance of payments. For the non-base scenarios, the following closures are used: (a) government: its accounts are balanced via adjustments in the direct tax rate; (b) savings-investment: private investment adjusts endogenously to maintain the balance between total funding (from different sources) and total private investment (that is, private investment is savings-driven); and (c) balance of payments: the real exchange rate equilibrates this balance by influencing export and import quantities and values; the non-trade-related payments of the balance of payments (transfers and non-government net foreign financing) are non-clearing, kept fixed as shares of GDP.

[30] Here it is important to keep in mind that the tobacco tax, like any other tax, generates a deadweight loss. In the particular case of Argentina, given the difference in initial tax rates between tobacco and the other goods and services (see Figure 4), it is expected that increasing the tax on cigarettes will have a significant efficiency cost. That is, this study's simulations start from a distorted situation, and increasing the tax on cigarettes is not compensating for any existing distortion because the authors are increasing a relatively high indirect tax to an even higher rate.

[31] The tax collection is what the tobacco tax can generate at the different rates. That is, starting from a rate equal to zero, successive increases in a tax rate initially generate increases in collection. However, after a certain threshold, the collection is reduced. In the extreme, it becomes zero when the tax brings consumption to zero. The intuition for this result is that the surplus marginal burden grows more than proportionally with the tax rate. In other words, the Laffer curve arises because consumers reduce their consumption of the product whose tax rate is increased.

private consumption and employment. To provide a better characterization of household's consumption, the Table provides households nominal expenditure on tobacco, the total number of sticks, and the average price per stick. Employment data is presented on thousands of jobs.

As expected, the increase in the relative price of tobacco products results in a decrease in tobacco products (cigarettes) consumption and an increase in revenues. Overall, household tobacco products consumption decreases by about 12.7 percent in 2021 (see Tobacco consumption, in units, in Table 1).[32] In terms of units (20-stick cigarette packs) this reduction represents approximately 218 million cigarette packs in the short term (1.509 billion packs in Scenario 2 versus 1.728 billion in the baseline scenario, by 2021). To put this in context, around 150 million packs of cigarettes are consumed monthly in Argentina. In addition, and to assess the relevance of general equilibrium (or indirect) effects, the authors develop a smaller partial equilibrium model to simulate the same shock.[33] In this alternative model, the overall decrease in tobacco products consumption is 16.4 percent; that is, the general equilibrium adjustments imply that the decrease in tobacco products consumption is reduced by 3.7 percentage points.[34] The average price per stick increases by approximately 39 percent, after the tax change (see Tobacco price, pesos per stick, 356.84 in Scenario 1 vs 256.72 in Base). This is in line with the recorded increase by administrative data. Finally, as a result of the changes in prices and quantities, households spend 21.4 percent more on cigarettes (see Tobacco expenditure, billions of nominal pesos, 538.57 in Scenario 1 vs 443.61 in Base)

Regarding tobacco tax collection, it can be observed that revenues increase in all scenarios by around 60 percent (for example, from $70.97 billion to $113.91 billion in the short term of Scenario 1). This increase in public revenues, which also considers collection from the internal tax, takes place both in the short and in the long term.[35] Overall tax collection increases by around 0.7 percent.[36]

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[32] Note that this reduction is very similar to the one observed in official administrative data. See Section 2. This change is calculated using the value of Tobacco Consumption (billion units) from Private Consumption in 2021 of scenario 2 and the corresponding baseline scenario. That is, 1.509 vs. 1.728 in units. See Table 1.

[33] Mathematically, a relatively simple partial equilibrium model is developed with the following two equations:

$$pqs_c = PQD_c(1 - tq_c)$$

$$QH_{c,h} = \gamma_{c,h} + \frac{\beta_{c,h}}{PQD_c}\left(eh_h - \sum_{c' \in C} PQD_{c'} \cdot \gamma_{c',h}\right)$$

where PQD_c is the (endogenous) demand price of commodity c, pqs_c is the supply price of commodity c, tq_c is the tax rate on commodity *c*, $QH_{c,h}$ is the (endogenous) quantity consumed of commodity *c* by household *h*, is the eh_h household consumption expenditure. In this model, the authors impose the ubiquitous partial equilibrium assumption that consumers (households) bear the entire burden of the tax. To allow a meaningful comparison, the authors calibrated this model using the same dataset that is used to calibrate GEM-Core Argentina. Note that this reduction of around 16 percent in tobacco consumption is in line with that found in the partial equilibrium simulation of CEDLAS (2020).

[34] In an input-output analysis such as the one in Ghaus et al. (2018), the partial equilibrium decrease in private consumption would be compensated by a 1:1 increase in government consumption. See Appendix 4 for a Comparison of I-O Models and CGE Models for the Analysis of Tobacco Taxation. However, such an exercise would ignore the deadweight loss (or excess burden) of taxation. The deadweight loss of taxation is defined as the welfare loss (measured in dollars) created by a tax over and above the tax revenue generated by the tax. The inefficiency of any tax is determined by the extent to which consumers and producers change their behavior to avoid the tax; deadweight loss is caused by individuals and firms making inefficient consumption and production choices in order to avoid taxation. In fact, this study's results show that the negative impacts of tobacco product taxation outweigh the benefits that could occur from the additional fiscal space. Needless to say, the analysis in this report neglects any positive health effects from reduced smoking.

[35] As mentioned in Section 2, the May 2016 reform increased tax collection by around 37 percent. Naturally, although tax collection increase in both cases, the higher tax collection in this study's simulation can be explained by simulated direct and

For the sake of brevity, and given the focus of this policy report, the authors concentrate here on changes in employment. Both the gross and the net impacts are behind the reported estimates. The gross impact accounts only for the direct effect of reduced tobacco sales, while the net effect also includes the substitution and income effects among consumers and the effects of government decisions on additional revenues. In tobacco growing (Tobacco, in Table 1), given the assumption of constant output with exports determined as a residual once domestic demand is satisfied, employment shows small changes; it falls by 0.01 percent[37] in the short term and by 0.4 percent (around 108 jobs) in the long term under Scenario 2. This reduction is negligible and does not impact overall agricultural production. In tobacco manufacturing production (Tobacco production, in Table 1), the reduction in employment is approximately 5.6 percent in the short term and 5.0 percent in the long term.

Changes in total employment are negative in the short term, regardless of the simulated scenario, although small in magnitude (around 0.02 percent). In the long term, changes in total employment are negative for Scenario 1 and positive for Scenario 2. Again, in both cases, these changes are negligible. The negative changes in the tobacco sector are greatly reduced or even canceled out when the government uses the additional tax revenues to increase spending on education and health (Scenario 1) or highly productive public investment (Scenario 2). In the latter case, the gains in employment in other sectors more than compensate for the losses in the tobacco sector in the long term. For instance, if the government returns the new tax revenue (the additional amount as a result of the tax increase) in the form of public investment spending to the economy, in the short term the reduction in total employment is 0.03 percent (6,237 jobs out of a total of 20.6 million jobs). However, in the long term a net employment increase of 787 jobs is estimated. This is close to a zero-net change in employment, as it represents a 0.004 percent increase in jobs that would not have existed without the tax. Similarly, a nearly zero net change in employment can be observed in alternative scenarios.

The authors conduct several sensitivity analyses for this study's results. First, a piecemeal sensitivity analysis is performed with respect to the price elasticity of demand for tobacco products. Specifically, the authors re-estimate the scenarios under alternative assumptions for the price elasticity of demand for tobacco products; the authors consider elasticities in the range of 0 to 1.[38] Second, the authors also repeat the simulations under the extreme assumption that the production of tobacco products does not require labor. Finally, the authors perform systematic sensitivity analyses with respect to all model elasticity values. The study's main results still hold after all these robustness checks.

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indirect effects that did not necessarily take place in 2016. Here it should be noted that this is only an approximation and that reconciling the result of the CGE with what happened in reality may not be adequate. It is enough to emphasize that the comparison is between 2016 and 2021.

36 Note that the increase in tobacco tax collection is greater than the increase in total tax collection. This is mainly due to the fact that tobacco tax collection represents approximately 1.5 percent of the total collection. There are also general equilibrium mechanisms in which tobacco tax increases generate reallocations, as described in section 4.3, which reduces collection of other taxes. In any case, the increase in the tobacco tax collection more than compensates these potential reductions in other taxes.

37 This change is calculated using the value of total employment in 2021 of scenario 2 and the corresponding to the baseline scenario. That is, 24,061 vs. 24,064. See Table 1.

38 See Appendix 2 of this policy report. Figure A2.4 shows the percent change in total employment under alternative values for the own-price elasticity of tobacco products demand; all other elasticities are kept at their central values (see Table A2.2). Trivially, all non-base scenarios in this case promote the production of sectors that are more labor intensive than tobacco products. Interestingly, CGE studies do not usually test the sensitivity of their results to the factor composition of sectoral value added.

Finally, it is important to note that these results are in line with previous empirical evidence for other countries and for the application of so-called sin taxes to other goods such as alcohol or sugar-sweetened beverages. For example, Jha et al. (2020) use a full-fledged global CGE model to analyze the case of Tanzania.[39] Their results indicate that a 30 percent reduction in prevalence could lead to employment losses of about 20.8 percent in tobacco and 7.8 percent in the tobacco products sector. However, when compensated by increases in other sectors the overall decline in employment is only 0.5 percent. Chaloupka et al. (2017) analyze the net impact of two hypothetical alcohol tax increases (a 5-cent-per-drink excise tax increase and a 5-percent sales tax increase on beer, wine, and distilled spirits, respectively) on employment in Arkansas, Florida, Massachusetts, New Mexico, and Wisconsin. Their results show that, although gross employment falls, both taxes on alcoholic beverages increase net employment when new tax revenues are allocated to general expenditures. Chaloupka et al. (2014) assess the impact of sugar-sweetened beverage (SSB) taxes on net employment in Illinois and California and find that employment within the beverage industry declines but is offset by new employment in the non-beverage industry and government sectors.

Table 1. Key macroeconomic variables CGE estimation: Baseline and simulated scenarios.

	Base			Scenario 1		Scenario 2	
	2018	2021	2025	2021	2025	2021	2025
Value added (billion pesos)							
Overall economy	12552.916	12184.934	13684.996	12183.778	13681.667	12182.637	13703.952
Tobacco	7.230	7.051	7.757	7.050	7.755	7.049	7.760
Tobacco production	13.636	13.526	14.627	11.887	12.575	11.887	12.788
Production (billion pesos)							
Overall economy	23549.314	22848.856	25647.202	22843.786	25637.481	22843.869	25682.219
Tobacco	7.065	6.890	7.580	6.890	7.580	6.890	7.580
Tobacco production	40.972	40.642	43.949	35.717	37.785	35.716	38.425
Exports (billion pesos)							
Overall economy	2070.968	2011.091	2250.374	2009.923	2248.617	2010.225	2253.898
Tobacco	3.488	3.349	3.744	3.905	4.421	3.904	4.209
Tobacco production	0.509	0.488	0.554	0.496	0.524	0.497	0.562
Imports (billion pesos)							
Overall economy	2398.260	2320.101	2592.001	2319.519	2591.013	2319.780	2595.201
Tobacco	0.376	0.383	0.403	0.438	0.453	0.437	0.312
Tobacco production	1.092	1.120	1.152	0.849	0.898	0.847	0.865
Tax revenues (billion pesos)							
Overall economy	4290.679	4158.019	4652.885	4186.353	4678.646	4181.972	4682.835
Tobacco	69.754	70.976	74.442	113.919	120.707	114.001	119.603
Private consumption							
Tobacco expenditure (billion nominal pesos)	141.554	443.616	1240.906	538.574	1476.468	538.504	1498.150
Tobacco consumption (billion units)	1.740	1.728	1.865	1.509	1.596	1.509	1.620
Tobacco price (pesos per stick)	81.367	256.720	665.415	356.841	924.927	356.841	924.927
Employment (in thousands)							
Overall economy	20,554,552	20,876,027	21,991,225	20,869,989	21,983,743	20,869,790	21,992,013
Tobacco	23,507	24,064	24,435	24,061	24,436	24,061	24,328
Tobacco production	5,908	6,525	6,110	6,157	5,806	6,157	5,807

Note: The short term indicates effects for 2021 while the long term indicates effects for 2025. Alternative scenarios for newly raised tax revenues: Scenario 1) the government increases spending on education and health; Scenario 2) the government increases spending on public infrastructure investment with high marginal product of capital.
Source: Authors' calculations based on simulation results

[39] Specifically, these authors use the well-known GTAP model and dataset.

5. Conclusions and Policy Implications

Increasing tobacco taxation is one of the most broadly adopted measures by governments to discourage tobacco consumption and promote a healthier and more productive population. Critics of these measures often invoke potential detrimental effects on employment because of reduced tobacco sales. The results from this study's CGE analysis show that a substantial 15 percentage points increase in tobacco taxation in Argentina can generate a net increase in employment in some scenarios (if the newly raised tax revenues are spent by the government on employment-intensive public infrastructure). Furthermore, while tax increases may reduce employment in the tobacco sector these losses are nearly zero in net terms for the whole economy, even in worst-case scenario assumptions. Increased tobacco taxes may shift jobs from tobacco-related sectors to other sectors of the economy, but the overall impact on the total number of jobs is negligible. Based on these results conclusions indicate that substantial increases in tobacco taxes can even increase aggregate employment in the medium term. Additionally, governments can mitigate and even reverse any adverse employment effects of increased tobacco taxes by devoting the additional tax revenue to increase expenditure on social services and infrastructure.

To the authors' knowledge, this is the first comprehensive assessment of the impact of tobacco tax increases on employment for Argentina considering general equilibrium effects. This study's findings show that increasing tobacco taxes would not have the unintended consequence of job losses. Results for the Argentinean case are in line with previous empirical evidence for other countries and for the application of so-called sin taxes to other goods such as alcohol or sugar-sweetened beverages. The study's findings can be used to debate public policies aimed at discouraging the consumption of tobacco and other goods that produce negative externalities.

The results from this study's CGE model demonstrate that the widely documented positive effects of higher tobacco taxes (such as a healthier population, more productive workers, savings in the avoided medical costs of treatment of tobacco-related diseases, reductions in the number of new young smokers, among others) will almost certainly far outweigh the nearly null effect of higher taxes on total net employment.

Naturally, this analysis is not free of limitations, and some caveats need to be made. First, this study does not incorporate the health benefits of controlling tobacco (such as lower medical expenses, longer life expectancy, and more time for income-generating activities). These benefits are crucial for analyzing the effects of higher tobacco taxation on inequality and can play a relevant role in studying the effects of taxation on economic efficiency. For instance, fewer smokers results in more productive workers and – very important for the case of Argentina, given its public-private health system – savings in the treatment of tobacco-related diseases. In this context, this study's results can be interpreted as a lower bound, and the actual effect of higher taxes on overall employment is almost certain to be positive. Further research should include the positive effects of tobacco taxation into the CGE model to gauge its indirect employment effects against the direct impacts of increased taxation.

Second, the authors simulate a substantial 15 percentage points increase in tobacco taxation, which, given the high initial tax burden on tobacco in Argentina, could generate a disproportionately high deadweight loss. In other countries facing initial lower taxes on tobacco, the deadweight loss of raising taxes should be lower and the effect on employment could be positive and larger than for the case of Argentina. In addition, the authors do not analyze this tax increase along with other tobacco control measures that are relevant in Argentina, such as the Law 26687, implemented in 2011, which regulates the advertising, promotion and consumption of products made with tobacco. Third, the authors do not attempt to calculate any productivity increase that might arise, for example, by an improvement of soil quality that may have deteriorated due to the toxicity of tobacco. In reality, there would be an increase in yields and productivity, which in turn means the effects would be more positive than this study's predictions.

Possible extensions of this work set the agenda for future research. These extensions consist in exploring the effects of tobacco taxes from a CGE perspective on health and on income distribution. In the first case, two channels could be considered: the direct one through decreased cigarette consumption and the indirect one by assuming that an increase in public spending on health has effects on the well-being of individuals. Regarding distributional effects, a comprehensive incidence analysis can be done, considering both the direct effect of taxation and the consequences of improvements in the health of smokers (indirect effects). For instance, poorer smokers are more price-elastic to tobacco taxation (CEDLAS, 2020) and are also the ones that utilize public health the most, so poor individuals quitting smoking should result in savings for the government in its provision of health services. Finally, a comparative analysis between countries can be performed. This would allow identifying the structural characteristics of the countries that explain different results between them.

Last but not least, and based on this study's findings, some policy recommendations can be suggested. First, given the displacements generated by higher taxes in the tobacco growing sector, smart extensions of existing rural development programs can help cover farmers' transition costs. Additional funds resulting from higher taxation could be used to finance these costs. Second, to cope with employment reduction in tobacco manufacturing, training displaced workers in alternative sectors as well as in alternative forms of employment becomes crucial. Third, some of the increased tax revenue could be directed to alternative cultivation through new programs such as agricultural extension services, training for services, and other forms of industrial production. Again, alternatives to financing training programs or transition costs could include using newly raised tax revenues or a combination between new revenues and existing funds (such as FET). Along the same lines, the allocation of the newly raised tax revenues should be guided by an evaluation of where these funds would be more productive in easing the transition to new forms of production. It is essential to detect where these revenues have the highest relative profitability, since potential negative effects can be reversed with an accurate application of new revenues. Fourth, when designing tax policies for the sector, policy makers should not only consider issues related to efficiency but also look at the effects of policies on income distribution, tax collection, and tax administration. Fifth, and perhaps most important, policy makers should be clear about the main objective of these taxes: the public health goal of tobacco tax increases is to reduce tobacco consumption and its negative consequences. The ultimate purpose of this measures is the long run positive economic consequences stemming from the improvements in health and the environment.

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Appendix 1. Tobacco Tax Structure in Argentina and Tax Burden Estimation

As described in Section 2, in Argentina tobacco taxation includes several different taxes that jointly set up a complex tax structure. Given the current tax structure, total tax burden on final price (PF) can be estimated through the following equations system.

IAE=7%*PF

VAT= 21%/(1+21%) (PF-IAE- INT -FET)

FET=1.7 + 8.35%*(PF-IAE-IVA)

INT=70%*(PF-IAE-VAT-FET-STT)

STT=4.77%*(PF-IAE-VAT-FET-INT)

Solving the system, each equation can be expressed as a share of PF as follows.

System A1. 5-equations system for tobacco tax burden estimation

$$\begin{cases} a = 0.07\,P \\ v = 0.0524213\,P - 0.104554 \\ f = 0.0732778\,P + 1.70873 \\ i = 0.554676\,P - 1.1063 \\ t = 0.0119071\,P - 0.0237487 \end{cases}$$

Source: Authors' own elaboration

Using a final price (PF) of 130 pesos (as an approximation of current prices in 2020) each component of the tax structure takes the following values, in current pesos. Overall tax burden accounts for 77 percent of PF.

Table A1. Tax burden of tobacco in Argentina, by each tax that affects tobacco consumption

IAE	$	9.1
VAT	$	6.7
FET	$	11.2
INT	$	71.0
STT	$	1.5
Overall Tax Burden	$	99.6
as % of price	77%	

Source: Authors' own elaboration

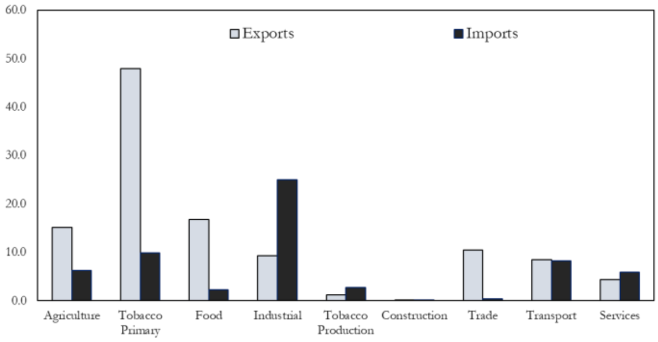
Appendix 2. Supplemental Figures

Table A2.1 Accounts in the social accounting matrix (SAM), disaggregation of GEM-Core Argentina, 2018

Category	Item
Sectors (activities and commodities)	Primary (10): *other crops, livestock and forestry; tobacco (7)*; fishing; mining.*
	Manufacturing (17): *food and beverages; tobacco products; textiles; wearing apparel; leather; wood; paper; printing; refined pet products; chemical prod; rubber and plastic; non-met min prod; basic metals; metal prod; machinery and equipment; vehicles; other manufacturing*
	Other industry (2): *electricity, gas and water; construction*
	Services (12): *trade; hotels and rest; transport and comm; financial ser; business ser and real estate; public administ; education, gov; education, non-gov; health, gov; health, non-gov; other services; domestic ser*
Factors (5)	Labor (3)**
	Capital
	Land
	Natural resource, fishing
	Natural resource, mining
Institutions (4)***	Households (10)
	Enterprises
	Government
	Rest of the World
Taxes (9)	Tax, social sec cont
	Tax, capital use (ganancias empresas)
	Tax, value added
	Tax, commodities
	Tax, FET
	Tax, direct (households)
	Tax, exports
	Tax, imports
	Tax, activities
Investment (2)	Investment, private
	Investment, government

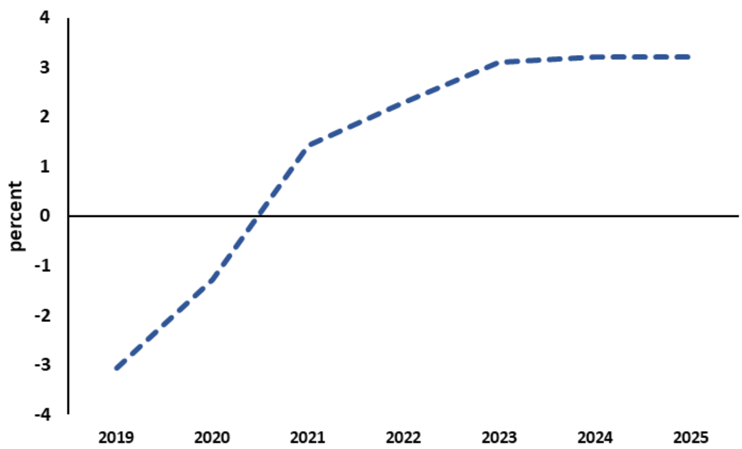
*Tobacco is disaggregated between the seven producing provinces (Catamarca, Corrientes, Chaco, Jujuy, Misiones, Salta, and Tucumán).
**Labor is disaggregated into three categories according to skill level.
***The institutional capital accounts are for domestic non-government (aggregate of households), government, and rest of the world.
Source: Authors' own elaboration

Figure A2.1 Export intensity and import intensity (%), by sectors, 2018



Notes: * Ratio between exports and output. ** Ratio between imports and demand.
Source: Authors' calculations based on 2018 Argentina SAM

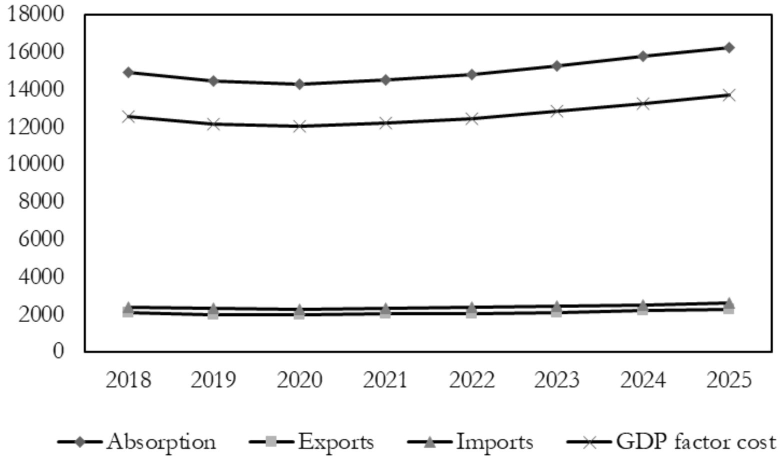
Figure A2.2 GDP growth rate (%), 2019–2025



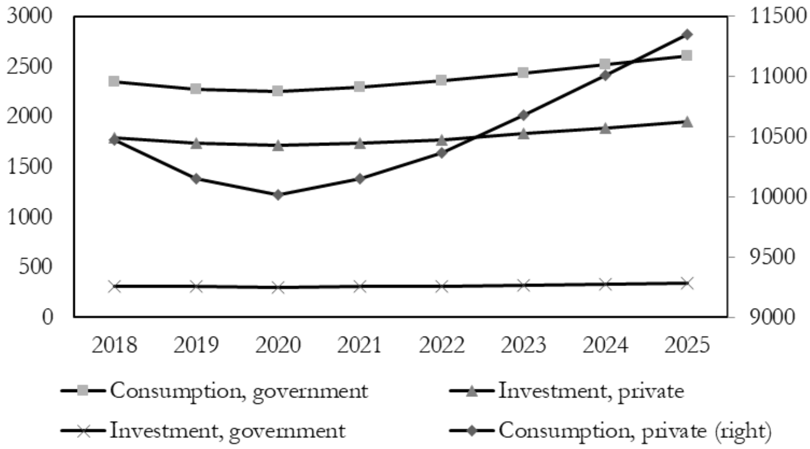
Source: Authors' calculations based on simulation results

Figure A2.3 Baseline scenario: GDP, foreign trade, and domestic final demand aggregates (in billions of pesos), 2018

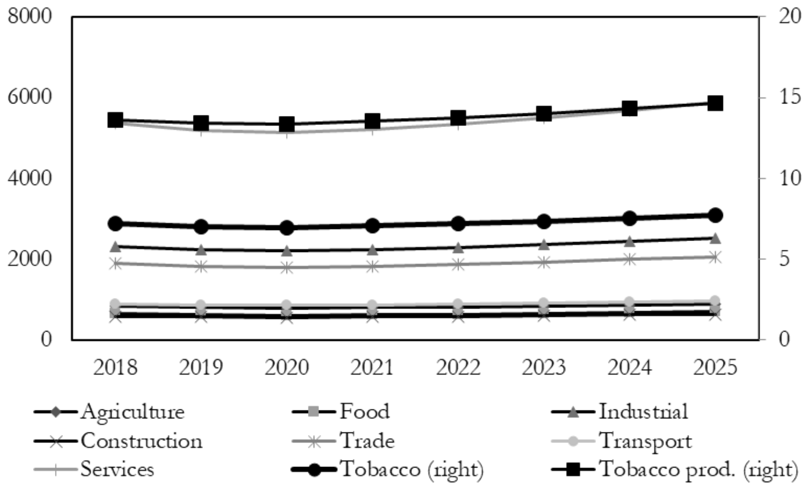
Panel A. Foreign trade, GDP, and absorption



Panel B. GDP composition, by aggregates

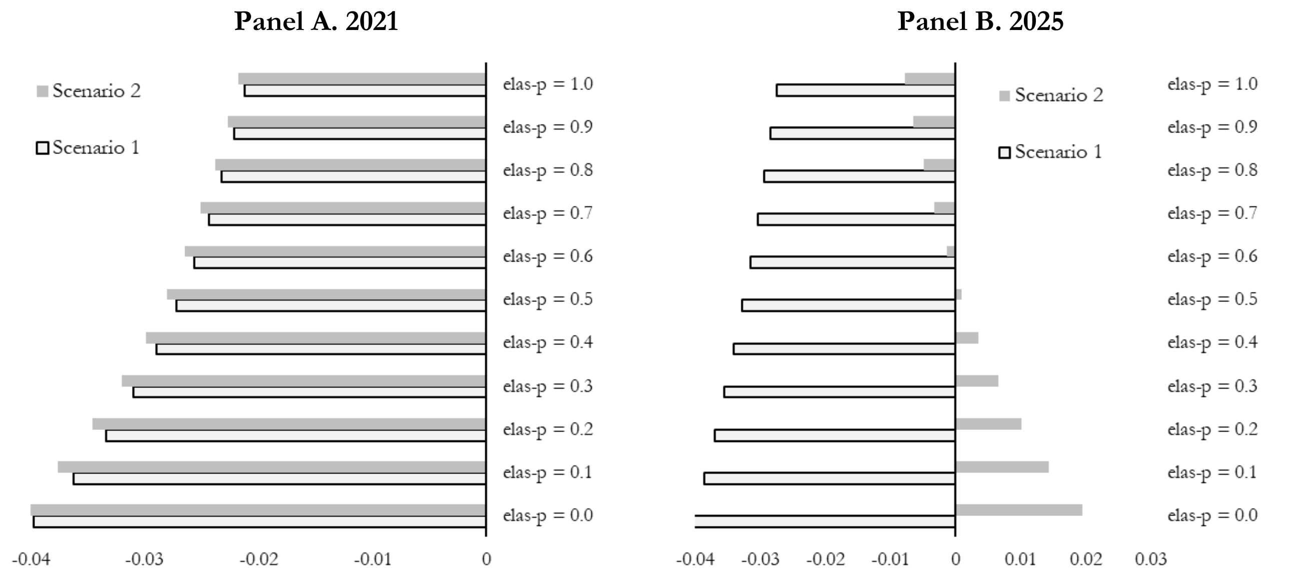


Panel C. GDP composition, by sectors



Source: Authors' calculations based on simulation results

Figure A2.4 Sensitivity analysis of total employment by simulation in 2021 and 2025: Percentage level deviation from base



Source: Authors' calculations based on simulation results

Table A2.2 Elasticities

	VA	Armington	CET	elas-p
Other crops, livestock and forestry	0.250	2.000	2.000	-0.988
Tobacco	0.250	2.000	2.000	-0.400
Fishing	0.200	2.000	2.000	-1.000
Mining	0.200	2.000	2.000	-1.000
Food and beverages	0.900	1.500	1.500	-0.988
Tobacco products	0.900	1.500	1.500	-0.400
Textiles	0.900	1.500	1.500	-1.000
Wearing apparel	0.900	1.500	1.500	-1.000
Leather	0.900	1.500	1.500	-1.000
Wood	0.900	1.500	1.500	-1.000
Paper	0.900	1.500	1.500	-1.000
Printing	0.900	1.500	1.500	-1.000
Refined pet products	0.900	1.500	1.500	-1.000
Chemical products	0.900	1.500	1.500	-1.000
Rubber and plastic	0.900	1.500	1.500	-1.000
Non metalic minerals products	0.900	1.500	1.500	-1.000
Basic metals	0.900	1.500	1.500	-1.000
Metal products	0.900	1.500	1.500	-1.000
Machinery and equipment	0.900	1.500	1.500	-1.000
Vehicles	0.900	1.500	1.500	-1.000
Other manufacturing	0.900	1.500	1.500	-1.000
Recycling	0.900	0.800	0.800	-1.000
Electricity, gas, and water	0.900	0.800	0.800	-0.450
Construction	0.900	0.800	0.800	-1.000
Trade	0.900	0.800	0.800	-1.000
Hotels and restaurants	0.900	0.800	0.800	-1.000
Transport and communications	0.900	0.800	0.800	-1.000
Financial services	0.900	0.800	0.800	-1.000
Business servicesand real estate	0.900	0.800	0.800	-1.000
Public administration	0.900	0.800	0.800	-1.000
Public education	0.900	0.800	0.800	-1.000
Private education	0.900	0.800	0.800	-1.000
Public health	0.900	0.800	0.800	-1.000
Private health	0.900	0.800	0.800	-1.000
Other services	0.900	0.800	0.800	-1.000
Domestic services	0.900	0.800	0.800	-1.000

Source: Authors' calculations

Appendix 4. Comparison of I-O Models and CGE Models for the Analysis of Tobacco Taxation

In research reports such as Ghaus et al. (2018), input-output (I-O) models have been used to estimate the economic impacts of increased in tobacco taxation. However, these models have very restrictive assumptions that affect the accuracy of their estimates. Most importantly, these assumptions include the following.

First, all inputs and resources are supplied freely, and no resource constraints exist. In real world economies, however, resource constraints generally are present and must be considered when estimating impacts of increased tobacco taxation. In other words, I-O modeling produces positive impacts when total final demand increases, and it does not recognize that expanding one sector of economic activity tends to crowd out other sectors of economic activity.

Second, a constant returns to scale production function is assumed with no substitution among the different inputs such as labor, capital, and intermediate inputs. In other words, the constant technical coefficients assume away diminishing marginal returns to inputs in production activities and changes in input mix due to price-induced substitution between factors. It is also assumed that there are fixed budget shares in household consumption. Hence, if households change their demand patterns when the price of tobacco products rises, this assumption will be violated.

Third, input and output prices are assumed to be fixed. In reality, there are likely to be capacity constraints in the economy that cause prices to increase/decrease in an expansion/contraction of economic activity. For instance, wage and other input price rises will limit the extent of an expansion and may even lead to contractions in economic activity in some sectors.

Fourth, exchange rate changes are ignored. I-O modeling does not allow for effects through international trade; for example, through increased export demand pushing up exchange rates and reducing the competitiveness of import competing firms with adverse effects on income and employment in those sectors.

Fifth, in I-O models, the government budget is ignored. In reality, a change in one or more tax rates will have an impact on the government receipts and spending. In fact, I-O models cannot capture an endogenous response to a change in one or more tax rates.

Overall, these restrictive assumptions imply that the I-O model exaggerates the economic impacts of whatever approximation is made to assess the impact of a change in one or more tax rates.

In this research report, the authors argue that real world features of demand and supply that affect the economic (and particularly employment) impacts of tobacco taxation can only be properly considered using a computable general equilibrium (CGE) model. The term "computable" describes the capability of this type of model – based on underlying economic benchmark data (or representation of an economy) – to quantify the effects of a shock to an economy. The term "general" means that it embraces multiple economic agents interacting simultaneously. In its simplest version, equilibrium in a CGE model occurs at that set of prices at which all producers, consumers, workers, and investors are satisfied with the quantities of goods and services they produce and consume, the number of hours they work, and the amount of capital they save and invest. Interestingly, CGE models have their historical origins in the input-output method but were developed to overcome the shortcomings of I-O models.

Generally speaking, CGE models capture a wide set of economic impacts derived from a shock or the implementation of a specific policy reform. They allow for the inclusion of the constraints absent from I-O calculations and allow flexible prices, wages (or employment levels), and rents. They include more general specifications of the behavior of consumers, producers, governments, and investors than I-O models. For instance, substitution possibilities are incorporated so that the behavior of agents in the model economy is sensitive to changes in relative prices as well as to quantity variables.

CGE models treat an economy as a whole, allowing for feedback effects of one sector on another. By setting up the economic conditions whereby each market, sector, and household reacts to changes in the economy, a CGE approach can model a variety of possible scenarios to fit different real-world circumstances. In a CGE model, the initial stimulus can originate anywhere in the economy and can be literally anything that can occur in an economic framework.

Nowadays, CGE models are widely used to assess the aggregate welfare and distributional impacts of policies whose effects may be transmitted through multiple markets, or contain mixtures of different taxes, subsidies, quotas, or transfer instruments. CGE analysis is a standard tool for the quantitative analysis of policy interference in domains as diverse as hazardous waste management, trade liberalization, tariff protection, environment–economy interactions, structural adjustment, carbon taxes, emissions trading schemes, effects of climate change, agricultural stabilization programs, technological change, labor market deregulation, financial market deregulation, fiscal reform, development planning, macroeconomic reform, economic transition, international capital linkages, environmental regulation, public infrastructure, and industry sector studies.

To sum up, the most important difference between I-O models and the CGE model is the partial economic analysis in I-O modeling versus the general equilibrium analysis in CGE modeling. The general equilibrium approach stands for a closed economic system where not only all products that are produced are used elsewhere but all income earned is spent on different products (possibly via savings on investments). The general equilibrium approach therefore describes the complete economy, accounting for all monetary and non-monetary flows. In contrast, partial economic analysis such as I-O analysis does not link income to expenditure. They are therefore demand-driven models where higher/lower income earned by an agent does not lead to more/less products demanded.