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AN ESTIMATE OF THE MARGINAL EXCESS BURDEN FOR THE MEXICAN TAX SYSTEM

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An estimate of the marginal excess burden for the Mexican tax system

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Abstract

This paper measures the societal costs of the government acquiring an extra monetary unit through taxation. The study aims to conciliate efficiency and equity criteria, therefore, estimate the efficiency cost of different tax instruments through the marginal excess burden (MEB) subject to an inequality aversion parameter by incorporating social utility functions. We simulate a static general equilibrium model, following a balanced budget approach to obtain results. Results show that for a relatively low inequality aversion parameter and onwards, income tax in Mexico is the most costly: on average, the welfare loss associated is in the range of 4.6$ (when inequality aversion is low) to 0.28$ (when inequality aversion is high) per peso of additional revenue. Furthermore, income tax derived the most dispersed MEB signaling greater opportunities for reform within the instrument. Factor tax carriage the less efficiency cost for all levels of inequality aversion. Consistently in the case of value-added tax, foodstuff yielded the least distortion. The results demonstrated robustness to varying values of elasticity substitution between labor and capital.

Keywords: *marginal excess burden, cost of funds, taxation, efficiency cost, equity, general equilibrium, social accounting matrix.*

Contents

Introduction

Taxes induce distortions because, without market failures, they cause equilibriums that are not firstly optimally derived. Nevertheless, at the same time, one of the most fundamental rationales for their existence regards income redistribution. The so-called efficiency equity trade-off refers to how using taxes to redistribute income changes an individual's behavior impeding valuable transactions. In simple terms, with taxes, each person receives a greater slice of a reduced pie. For example, in Mexico, persistently high levels of inequality are accompanied by low tax revenue as a percentage of GDP; in principle, the objectives of enhancing tax revenue and reducing inequality are irreconcilable since the loss in efficiency (and gain in equity) produced by higher taxes, would eventually result in lower tax collection as the base shrinks (see discussion in Casares et al. (2015)). To conduct a fiscal reform that accounts for equity and efficiency criteria is necessary to fix a particular set of distributional values and weight for the efficiency losses produced in that constraint. Therefore, although increasing tax revenue and reducing inequality are competing just as efficiency and equity, isolating them in whichever policy debate is undesirable.

This paper aims to calculate the efficiency costs associated with several tax instruments through the welfare loss per unit of extra government revenue that stems from them. I present the estimates of those marginal excess burdens (MEB) for a broad range of distributional attitudes toward inequality. The study's relevance links with the issues discussed in the last paragraph since the results could serve as a potential guideline to induce reforms that, given an inequality aversion parameter, improve welfare by reducing taxes with relatively high-efficiency costs and increasing taxes with relatively low-efficiency costs. This piece of work solely presents the results and outlines the potential welfare benefits without suggesting a tax reform. Therefore, it is an initial step towards fiscal reform considering both efficiency and fairness criteria. Explicitly, the questions the investigation addresses are: What are the most and less distortive tax instruments across the tax system? Which sector presents the highest and lowest efficiency costs within a specific tax instrument? How significant are the opportunities for reform? Finally, How do the last three questions change as the inequality aversion parameter varies?

To answer the above and given the transversality of taxes over a long list of consumption and production decisions, We use static general equilibrium simulations to elucidate as much as possible. Moreover, since the objective relies on providing a point of departure, the model's character remains frictionless. However, the model appropriately captures Mexico's tax structure and income distribution. The process of parameter calibration implied the construction of a Social Accounting Matrix (SAM), which essentially is based on the input-output table with adjustments necessary to match the disaggregation of household income in ten deciles and the aggregation of goods into the nine large expenditure items from the National Survey of Household Income and Expenditure. The inclusion of equity criteria in the analysis implicated the construction of social utility functions. The simulations involve 1% increases in the effective tax rate of factor, excise, import, value-added, and income taxes. The associated MEB (efficiency cost) with a determined inequality aversion parameter for each tax instrument is measured as the standard practice in the literature, as the quotient of the Hicksian equivalent variation and the change in government revenue.

The study's key findings are that income tax prevails as the instrument with the highest MEB from somewhat low inequality aversion onwards (estimates range on average from 4.64\$ to 0.28\$ per peso of additional revenue). Therefore, as society cares at reasonable levels for redistribution, income taxes in Mexico become the most distortionary, challenging the standard idealization of income taxes as the closer to lump-sum taxation. Of course, the high-efficiency cost related to the instrument reflects its essential role in reducing inequality. Nevertheless, the presentation of the results advocates that gains should be in the form of efficiency once a specific equity criterion is satisfied. Import tariffs are the second most distortionary tax instrument (5.2\$ to 0.14\$ per peso of additional revenue). Within the value-added tax, We highlight the low social costs of taxes on food and medicines (1.92\$ to 0.087\$ per peso of additional revenue and 5.13\$ to 0.16\$ per peso of additional revenue, respectively). Social contributions in the form of a factor tax consistently stand as the less distortionary tax instrument (discussed later), and finally, excise taxes prove to be the second less distortionary element in the system.

The main contribution is that these estimates conform to a first attempt to calculate the marginal excess burden for Mexico (Erbil (2004) has a previous estimate only for trade tax, and his analysis includes several countries). One step further was the inclusion of distributional considerations in the investigation, emphasizing that societal costs of taxation are functions of how much we value equity gains. A common feature throughout the analysis is decreasing welfare losses due to taxation (efficiency costs) as inequality aversion increases.

The organization of the paper is as follows. Section 1 contains a literature review surrounding the measure used to estimate the efficiency cost of taxes (MEB). Section 2 fully describes the methodology involved in the general equilibrium simulations; this includes the presentation of the model, the data, the construction of the SAM, proper adjustments, parameter calibration, and the formulation of social utility functions. The estimates of the MEB are described in Section 3. Section 4 concludes by discussing the results emphasizing the drawbacks and extensions. Finally, the appendix contains the entire disclosure of results under different specifications of substitution elasticity among labor and capital to demonstrate the robustness of the ranks in the results presented in section 3.

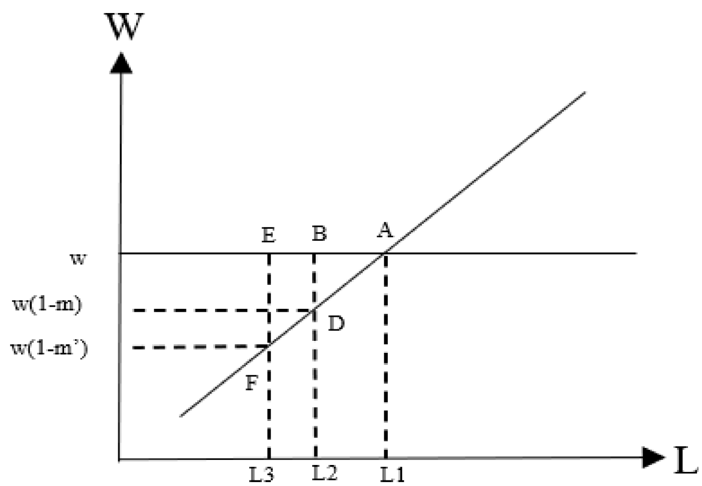
1 Literature review

The starting point for any study that estimates the marginal excess burden of taxation is Harberger (1964). To prove from artificial superiority of direct tax against indirect tax, Harberger builds from Little's argument that direct taxation would cause a distorted exchange rate among leisure and other goods once the labor supply is not entirely inelastic. In addition, he proposed a methodology to measure the welfare cost of excise and income taxes to round up the argument. From that exercise, Harberger's triangle emerges as the first way to approach the question of calculating the distortions (excess burden) induced by different tax instruments. Finally, Harberger proposed the average excess burden (the distortion of any given tax per dollar of revenue) from that total distortion cost. This concept was later introduced as input by Musgrave (1969) in a cost-benefit evaluation as one of the first considerations of distortions induced by taxes in policy debate.

Browning (1976) argues that the relevant feature to calculate distortions generated by taxes is the evaluation of expenditure programs. However, instead of using the average excess burden, he considers for the first time the marginal excess burden as the appropriate measure to assess efficiency costs associated with a given tax. Despite this, Harberguer's triangle remains at the center of his estimates. The central thesis from Browning is that per each dollar of government expenditure, the opportunity cost is the dollar diverted from private hands plus the efficiency costs associated with acquiring those funds (MEB). Therefore, a project would be socially desirable if the net marginal benefit that carries exceeds the marginal cost of funds ($MCF = 1 + MEB$).

Figure 1 reproduces Browning's illustration example of the marginal excess burden in the labor market in a partial equilibrium setting. First, the undistorted case in the figure is exemplified by the duple (w, L_1). Then, the government imposes an income tax with a marginal rate of m, and the market wage then lowers from w to $w(1-m)$; the equilibrium of this scenario, which was not at first optimally derived, is given by $(w(1-m), L_2)$. The earnings that the representative agent gives up from the contraction of labor supply are represented by the area BAL_2L_1. However, the leisure time gains are valued with the area DAL_2L_1. Therefore, the total excess burden imposed by the income tax refers to the area size of DBA (Harberger's triangle). Browning's example now assumes that the government is funding a new expenditure program by increasing the marginal income tax rate from m to m', the change in the total welfare cost provoked by the additional revenue unit, the marginal excess burden, is $BEFD$. Consequently, each time government induces a change over an initially distorted system (funding expenditure programs or proposing reforms), the relevant efficiency cost is the additional distortion, not total nor average. This idea prevails, and up to date, each efficiency cost of taxes estimation refers to the marginal nature of the measure with the standard stylized wording: How much does it cost to collect an additional monetary unit in taxes?

Figure 1: Browning's illustration of MEB in the labor market



Source: Own elaboration. Extracted from Browning (1976)

According to Stuart (1984), the estimates from Browning's MEB of 9 to 16 cents were biased. He criticized Harberger's triangle as a poor-fit approach to calculating the efficiency costs of taxes. Stuart explains that the formula of Harberger is accurate only in the proximity of undistorted equilibrium, with the additional restriction of linear production frontier. Assumptions are incredibly rigid since economies are not departing from undistorted equilibriums in the presence of a substantial amount of taxes. Also, constant marginal rates of transformation do not seem close to reality. Harberger's formula is appropriate to quantify the costs of not having a lump sum taxation system. Stuart points out that the formula reflects transitions from undistorted equilibria to fully compensated allocations. Last, even though the income tax in Browning's work achieved reduced labor supply, it could not capture the reduction in the taxable base. The solution proposed by the author to overcome the limitations imposed by Harberger's approach in measuring efficiency costs of taxation was a two-sector (taxed and untaxed) general equilibrium model.

Stuart's analysis was valuable in formalizing that the destination of the additional revenue generated by tax changes greatly influenced the MEB. It significantly impacts whether extra revenue is for government consumption or redistribution. Stuart discovered income effects encouraging workers to leave the taxed sector with redistribution. The income effects generated, complementing the substitution effects, ultimately lead to a societal cost of 20 cents per additional dollar of revenue. In contrast, the MEB is only 7 cents when the concurrent income allocates towards government consumption.

Up to this point, MEB only calculates labor market distortions using partial or small general equilibrium; furthermore, the debate over the conditions encompassing the experiment to obtain the estimate still needed to be settled. The theoretical and methodological conception of the efficiency cost of taxes changes with the seminal paper from Ballard, Shoven, & Whalley (1985). In terms of theory, their work introduces a clear distinction between the two types of experiments to calculate the marginal excess burden; both refer to the treatment of the additional revenue generated each time experiments make small changes in tax rates. The first type of experiment is the differential incidence, while the second refers to the balanced budget. In a differential incidence type of experiment, the size of the government is constant; for every change in distortionary taxes, a lump sum type rebate exists in the system's structure that maintains constant tax revenue collections. In a balanced budget experiment, extra revenue is spent on exhaustive expenditures. Authors evaluate the deadweight loss generated per 1% increases in tax rates per dollar of extra revenue with a balanced budget approach.

Regarding methodology, Ballard, Shoven, & Whalley (1985) was the first work to incorporate a computable general equilibrium model to address the efficiency cost of taxation. The model is one of the most sophisticated treatments in tax policy evaluation since it not only disaggregates the whole tax system but it incorporates elements such as 3 level nested utility functions endogenizing labor supply and savings decisions, 12 consumer groups, and dynamic considerations, among other features (full description in Ballard, Fullerton, et al. (1985)). In this manner, those authors could account for the most interesting substitution effects caused by taxes and extend them to intertemporal dimensions. Their measure of distortion compares the loss in consumer welfare in dollar terms from an increase in a determined tax relative to the revenue the increased tax generates. The calculation involved the equivalent variation measure representative of the mentioned welfare loss in monetary units. Authors discounted the streams of equivalent variations to present value due to the dynamic nature of the model. The aggregation of the Hicksian variations, however, did not imply a value judgment leaving aside from study equity implications.

Since the estimates of MEB from Stuart (1984) and Ballard, Shoven, & Whalley (1985) using a general equilibrium approach (15 to 50 cents per dollar of extra revenue) were considerably apart from Browning's partial equilibrium ones from 9 to 16 cents per dollar of extra revenue, Browning (1987), argues that differences arise from differences in key parameter calibration, not from different methodologies. Once parameter adjustments are concreted, Browning (1987) with the partial equilibrium approach can yield similar results to the general equilibrium ones. Ballard (1990), however, mentions that estimates are not comparable in the first place because they essentially refer to two different types of experiments. While Browning (1976) and Browning (1987) are from the differential analysis type, Stuart (1984) and Ballard, Shoven, & Whalley (1985) are from the balanced budget approach. The central characteristic of differential experiments, as discussed, is that each time a distortionary tax is changed, a lump sum rebate must guarantee equal revenue. Therefore, MEB estimates deriving from the latter approach are free from income effects.

Ballard (1990) found that changes in taxes generating extra income for the government's total expenditure can either reinforce or offset the substitution effects of taxation, provided that the expenditure is not a perfect substitute for cash. For example, government programs could affect the labor supply. If this supply is backward bending, the income effects of the program offset the substitution effects, so the MEB estimation should consider those total effects. In sum, when evaluating expenditure programs, an essential component that MEB should consider is the income effects, so a balanced budget experiment is desirable. A significant result of Ballard (1990) was to show that while compensated elasticities drove estimates of MEB in the differential case, the balanced budget estimates respond to the uncompensated elasticities. Interestingly, even if the labor supply elasticity is set to zero, taxation still incurs a positive marginal welfare cost; it becomes zero only in the absence of other taxes (which, in reality, is impossible).

With the previous discussion in mind, the efficiency cost of taxes measure related to differential analysis is expressed in (1), and the one linked with balanced budget experiments is (2), where EV stands for equivalent variation, and ΔR refers to the change in government revenue. (from Ballard (1990)).

$$-\frac{EV}{\text{amount of distortionary tax replaced by lump sum}} \tag{1}$$

$$-\frac{EV}{\Delta R} - 1 \tag{2}$$

To reinforce a large amount of consensus that Ballard achieved around measuring the efficiency cost of taxes, Fullerton (1991) incorporate crucial elements. First, he agrees that Browning's estimates of tax distortion from differential incidence experiments (contrary to balanced budget ones from Stuart and Ballard, Shoven, and Whalley) are insufficient to set government expenditure decisions since, as discussed, revenue effects are aside. Independently of the type of experiment, he proved that the relevant measure to evaluate the distortionary impact of taxes is the marginal cost of funds; therefore, either way, there is no need to subtract one from the MEB. Whether public spending is changing or there are lump sum rebates to prevent it, the cost that society incurs per additional unit of government tax revenue is the quotient between the equivalent variation and the change in government revenue[1], so this is finally the most appropriate measurement of the efficiency cost of taxation. Fullerton's paper regards this formula as the marginal cost of funds, but the terminology used depends on the context in which it is applied. The marginal cost of funds refers to the efficiency cost of taxes in partial equilibrium and reduced calculations, while MEB refers to those elaborated in general equilibrium settings (see Lemelin & Savard (2022)).

Exists other theoretical discussions regarding estimating the cost of taxes, like the reference price vector, or implications regarding interpreting a MEB greater than or equal to one. Suppose the reference price to evaluate change in welfare is pre-reform. In that case, the measure associated with the distortionary cost of taxation is at the differential analysis convention (Mayshar (1990) studies formal properties). By contrast, the price vector distorted by reform puts the calculation suited to the balanced budget world. González-Páramo (2003) discusses which measure is superior; the main result is that each has desirable properties. The measure related to the balanced budget case has the property that whenever $MEB_i \neq MEB_j$ for $i \neq j$, the tax system has efficient paths to be reformed until MEB equality, González-Páramo (2003) established as a general guide of reform the reduction of taxes with associated high MEB and vice versa[2]. However, no particular interpretation exists when it is greater or equal to one. The measure related to the differential case has the desirable property to be one when the tax is non-distortionary and invariant to the election of numeraire (see González-Páramo (2003)).

[1]Since the typical experiment in the differential case is to increase a tax marginally and decreased another in the form of lump sum rebate to maintain unaltered revenue one can equate the change in revenue from this formula with that lump sum transfer

[2]Other advantages have to do with the adequacy of the measure to be in cost-benefit analysis respect the evaluation of new expenditure programs, and with the role it plays in the theory of public goods provision. Beyond the scope of this paper.

To assess the efficiency cost of taxes, researchers must ensure consistency between the type of experiment, concurrent revenue treatment, and welfare evaluation at the appropriate vector of prices. Moreover, to be aware of properties and limitations, under which circumstances the standard is adequate, and the correct interpretation of it. For example, this paper adopts a balanced budget approach, using the accompanying revenue in household transfers and the equivalent variation evaluated at post-reform prices as a measure of welfare loss in monetary terms. If a tax creates distortions when it is greater than or equal to one, we cannot interpret the estimates in terms of whether or not it induces these distortions. However, comparing the estimates indicates potential for efficiency improvement.

As we outlined, two traditions divide the discussion of empirical estimates: analytical models (as Hansson (1985)) and simulation models (as Sancho (2003)). In addition, Dahlby (2008) reference many of the existent assessments of the social cost of taxation, per type of tax evaluated, the country or region, and the methodology. We would focus on the most related to this study, which implies using computable general equilibrium in contexts different from developed economies. We should emphasize that other than Erbil (2004) for trade taxes evaluated for several countries, Mexico has no other antecedent of estimates.

One of the initial points to study the efficiency cost of taxes for developing countries using general equilibrium simulations is the work from Devarajan et al. (2002); the essential feature is to follow a standard model, finding significant distortions of indirect taxation in Cameroon, Indonesia, and Bangladesh. Next, a more ambitious effort from Auriol & Warlters (2012), who evaluated the MCF for 38 African countries, incorporating informal sectors. Finally, the significant references for Latin America are Chisari & Cicowiez (2010) for Argentina and Rutherford & Light (2001) for Colombia. A treatment of assessing the efficiency cost of taxes with general equilibrium simulations using as principal data framework the input-output table is Rutherford & Paltsev (1999) for the case of Rusia.

Finally, although the incorporation of the equity criterion in the calculations of MEB is not a standard feature, exists efforts to study the sensibility of the efficiency cost of taxes estimates to several distributive weights (see Ahmad & Stern (1984) and Ahmad & Stern (1990)). Another approach proposes the construction of social welfare functions (see Sandmo (1998) and Slemrod & Yitzhaki (1995))

2 Methodology

Applied general equilibrium models have a well-documented series of steps to elaborate them (a classical reference Shoven & Whalley (1992)). Those steps involve the specification of the model, a consistent benchmark data set that calibrates the parameters, and the reproduction of the original equilibrium. Once satisfied those conditions, the model sets up to yield contrafactual equilibriums. The purpose of this section is to unwrap the execution of each stage. The last point implicates the exposition of the baseline model, the description and adjustments of data sources, the SAM construction and disaggregation, and the presentation of critical parameters that emanate from the SAM. In addition, at the end of the section, We also explore how we identified social utility functions and how they aided in integrating equity criteria into the analysis of the efficiency costs of taxation.

2.1 The model

The model represents a frictionless economy; standard assumptions regarded as perfect competition in all markets are followed, and capital and labor are fixed and fully employed. This modelization aims to provide a first reference point to contrast the welfare loss from an additional monetary unit of government tax revenue as assumptions depart from this baseline. The economy comprises nine productive sectors and ten groups of consumers who own the factors of production (see Sobarzo (2004) and Hirte & Wiegard (1988)). A two-level nested production function characterizes the production side of the economy (3) and (4). The first stage combines value added with intermediate inputs in fixed proportions, while the second stage generates the value added from a CES production function that combines labor and capital. As a result, the optimal demand of factors is given by (6) and (7). τ^f refers to the ad valorem tax of factor usage (note, however, that this is only accrued to one factor). Zero profit condition holds (8). Finally, (9) and (10) refers to the fixed supply of factors.

$$Y_i = min\left\{\frac{VA^i}{a_{0i}}, \frac{II_{1i}}{a_{1i}}, ..., \frac{II_{9i}}{a_{9i}}\right\} \tag{3}$$

$$VA^i = \Phi_i[\lambda_i L_i^{-\mu} + (1-\lambda_i)K_i^{-\mu}]^{-\frac{1}{\mu}} \tag{4}$$

$$\mu = \frac{(1-\epsilon_i)}{\epsilon_i} \tag{5}$$

$$L_i = \frac{1}{\Phi_i}\bar{Y}_i \left\{ \lambda_i + (1-\lambda_i) \left[\frac{\lambda_i r}{(1-\lambda_i) w (1+\tau_i^f)} \right]^{(1-\epsilon_i)} \right\}^{\frac{1}{\mu_i}} \tag{6}$$

$$K_i = \frac{1}{\Phi_i}\bar{Y}_i \left\{ (1-\lambda_i) + \lambda_i \left[\frac{(1-\lambda_i) w (1+\tau_i^f)}{\lambda_i r} \right]^{(1-\epsilon_i)} \right\}^{\frac{1}{\mu_i}} \tag{7}$$

$$q_i Y_i - \sum^{9} q_j a_{ji} Y_i - r K_i - w(1-\tau^f) L_i = 0 \tag{8}$$

$$L = \bar{L} \tag{9}$$

$$K = \bar{K} \tag{10}$$

Consumers $j = 1, ..10$ derive utility from consuming the nine goods. They maximize a Cobb-Douglas function (11) subject to their budget constraint (12), where $\tau_{inc,j}$ refers to the direct tax rate and T_j are transfers. The solution is (13) with s_j the savings rate.

$$U_j(c_{1j}, ..., c_{9j}) = \sum^{9} \alpha_{i,j} log(c_{i,j}) \tag{11}$$

$$BC_j = \left[\sum L_{i,j} w + \sum K_{i,j} r \right] (1-\tau_{inc,j}) + T_j \tag{12}$$

$$C_{i,j} = \frac{\alpha_{i,j}(1-s_j) BC_j}{P_i} \tag{13}$$

The P_i refers to the price of the composite good (14). Where Pm_i is the price of imports expressed in local currency (16), t_i is the tariff.

$$P_i = [\beta_i^{\sigma} Pd_i^{1-\sigma} + (1-\beta_i)^{\sigma} Pm_i^{1-\sigma}]^{\frac{1}{1-\sigma}} \tag{14}$$

$$Pm_i = P_i(1+t_i)ER \tag{15}$$

$$PN_i = Pd_i(1-td_i) - \sum^{9} a_{ij} P_j \tag{16}$$

The government's budget constraint is given by (17).

$$\bar{G} + T = (\sum^{9} L_i w + \sum^{9} K_i r)\tau_{inc} + \sum^{9} P_i M_i t_i + \sum^{9} Pd_i td_i Y_i + w\bar{L}\tau^f \tag{17}$$

Total investment is the sum of private savings and external savings, both in local currency (18); investment by sector of destiny allocates those resources in fixed proportions (19).

$$INV = \sum_j s_j BC_j + F(ER) \tag{18}$$

$$INV_i = share_i INV \tag{19}$$

To characterize all the demand components, the intermediate goods demand is (20), and exports (21), where $PWe_i = Pd_i ER$ and η is an export elasticity parameter.

$$V_i = \sum a_{ij} Y_j \tag{20}$$

$$E_i = C\left[\frac{\Pi}{PWe_i}\right]^{\eta^i} \tag{21}$$

Therefore, the total demand for domestic goods is $QD_i = RU_i(INV_i + C_i + V_i)$, where $RU_i = \frac{QD_i}{Q_i}$. Total internal demand is given by (22).

$$XD_i = QD_i + E_i \tag{22}$$

Finally, the equilibrium conditions require supply equals demand in the factor markets, goods market, and external balance, equations (23)-(26).

$$\sum L = \bar{L} \tag{23}$$

$$\sum K = \bar{K} \tag{24}$$

$$XD_i = Y_i \tag{25}$$

$$F = \sum P_i M_i - \sum PWe_i E_i \tag{26}$$

2.2 Data

The next step in elaborating general equilibrium simulations regards the construction of a consistent data frame, namely being able to calibrate model parameters from a SAM. A SAM is a schematic representation of the circular flow of income and expenditure; it entails the relationships between production sectors, households, government, and the world through transactions and transfers among them. In terms of form, it is a square matrix representing a balance since the sum of its rows must match the sum of its columns. Of course, there is no single way to construct a SAM, and depending on the researcher's interests, forms and data requirements change accordingly. The most practical approach, however, would be to rely on a single source and precisely convert an input-output table into a SAM; by this, We mean to incorporate income payment to a representative consumer derived from the factor's ownership. The more data requirements from external sources, the more likely the matrix becomes unbalanced, and consequently appeals to methodologies like RAS or cross-entropy to square up the matrix again. (Vast literature exists on the construction of SAM, for example, Núñez Rodríguez (2014), Santander & Cicowiez (2015), Téllez et al. (2009))

Since an essential element of this work relies on incorporating equity criteria in estimating the efficiency cost of taxes, more than the one-consumer approach would be required. Therefore, the necessary data to construct the SAM comes from the input-output table from INEGI (2013b) complemented by the National Survey of Household Income and Expenditure from INEGI (2014). The latter source allows to incorporate disaggregation of income distribution and consumption in ten groups of households. The main idea of complementarity of the sources is that both must have the same aggregation of sectors and goods, this task implies some reasonable assumptions, and at some point, the sectors from NAICS somehow correspond with a good fit with the survey's big expenditure items. Therefore, some sectors from the Input-Output table were matched to the survey following Ahmad & Stern (1990). Table 1 presents how we group the large expenditure items from the survey into nine categories.

After grouping the survey into the nine most essential expenditure items, we must repeat the exercise for the Input-output table. The importance that both data consist in the same aggregation to calibrate the SAM is that once in the same sectors/goods of analysis, the standard procedure dictates to work with one consumer in the input-output table; then, a process of expansion from that matrix in terms of consumers takes place (discussed in the next section). Finally, but most importantly, the associated expansion (through some adjustment factor) respects the income and consumption distribution from the Income Expenditure survey. A detailed explanation of this procedure is in Casares et al. (2017). Table 2 presents the corresponding aggregation in the defined nine sectors of the model, now for the case of the Input-output matrix.

The model appropriately captures Mexico's income and consumption distribution among ten deciles through the Income Expenditure survey respecting the aggregation of Table 1. In that case, it is important to describe that composition. Figure 2 represents the actual distribution of labor income in Mexico, assuming that the ownership of labor in the model derives as remuneration for subordinated work in the survey; data is in annual terms and millions of pesos. Figure 3 repeats the procedure, but now the ownership of capital refers in the survey as entrepreneurial and property rent. Both figures relate to the high concentration of income and wealth in Mexico.

In terms of how consumption of the nine relevant goods distributes among the ten income deciles, Figures 4 to 12 disclose the results. Figures 4,5 and 6 show how total annual consumption of food, beverages, and tobacco have an equal distribution relative to the other six goods. For example, in the case of these three goods, the last decile consumes no more the 20% of the total annual consumption value. For the case of medicine, clothing, housing, and transport consumption, Figures 7 to 10 reflect a greater disparity, where the last two deciles represent little less than half of each good's total annual consumption value. Finally, the most dispersed Figure is related to the consumption distribution of Non-tradable goods.

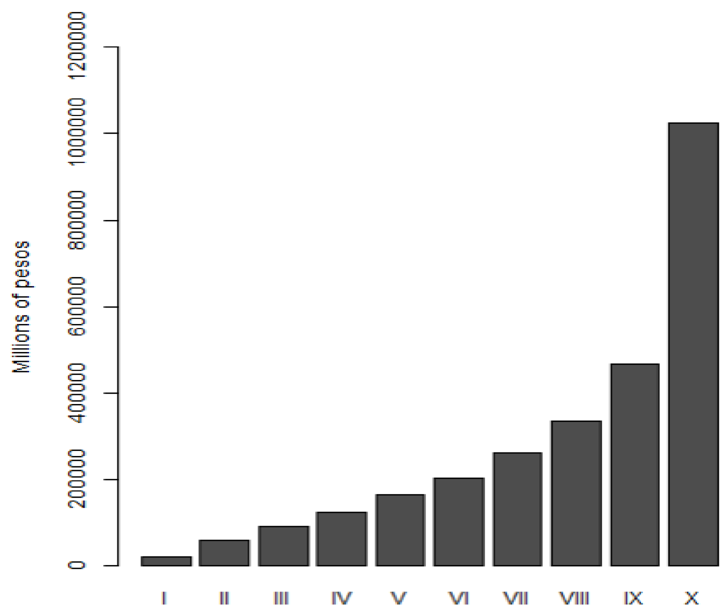
Table 1: Aggregation of goods Income Expenditure survey

Income Expenditure survey categories	**9 sector-Model treatment**
Food consumed inside home	Food
Drinks consumed inside home	Beverages
Food and drinks outside home	Non-tradable
Tobacco	Tobacco
Dress and footwear	Clothing
Rent	Housing, fuel and light
Property tax	Housing, fuel and light
Water	Housing, fuel and light
Electric energy and fuels	Housing, fuel and light
Conservation services	Housing, fuel and light
Cleaning items	Tradable
Cleaning services	Housing, fuel and light
Glassware and utensils	Tradable
Household goods and furniture	Tradable
Medicines	Medicines
Other health care	Non-tradable
Transportation, acquisition, maintenance	Transport and communications
Public transport	Transport and communications
Private vehicles, gasoline spare parts	Transport, and communications
Communications	Transport and communications
Articles for education	Tradable
Services for education	Non-tradable
Entertainment articles	Tradable
Entertainment services	Non-tradable
Lodging	Non-tradable
Articles for care	Tradable
Services for care	Non-tradable
Accessories and personal effects	Tradable
Other and transfers	Non-tradable

Table 2: Aggregation of sectors Input-output matrix

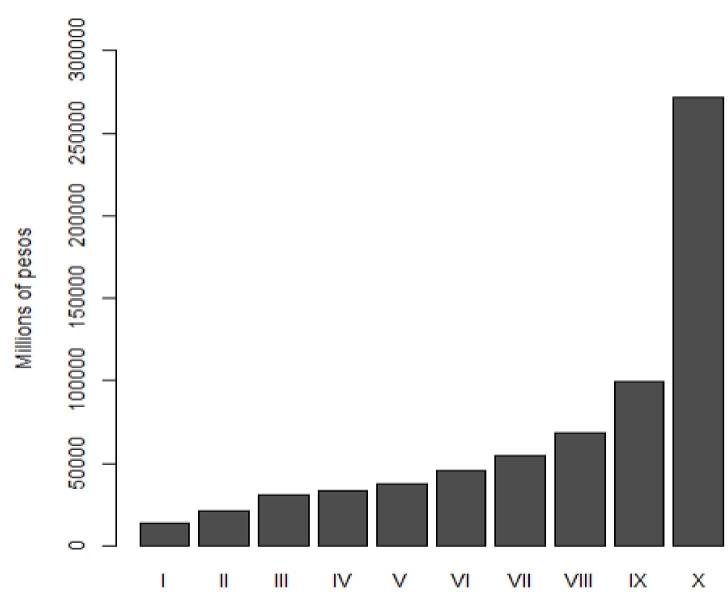
28-sectors from Input-Output matrix	**9 sector-Model treatment**
Agriculture	Tradable
Petroleum	Housing, fuel and light
Mining	Housing, fuel and light
Electricity	Housing, fuel and light
Construction	Non-tradable
Food	Food
Beverages	Beverages
Tobacco	Tobacco
Textiles	Tradable
Clothing	Clothing
Leather	Clothing
Paper and wood	Tradable
Pharmaceutical	Medicines
Chemicals	Tradable
Plastic and rubber	Tradable
Non metallic minerals	Tradable
Iron steel and non-ferrous metals	Tradable
Metal products	Tradable
Non electrical machinery	Tradable
Electrical machinery	Tradable
Transport equipment	Tradable
Other manufactures	Tradable
Trade	Non-tradable
Transport	Transport, and communications
Communications	Transport, and communications
Gas and water	Housing,fuel and light
Financial services and house insurance	Non-tradable
Other services	Non-tradable

Figure 2: Annual labor income distribution



Source: Own elaboration with data from INEGI (2014)

Figure 3: Annual capital income distribution



Source: Own elaboration with data from INEGI (2014)

Figure 4: Food consumption distribution among deciles

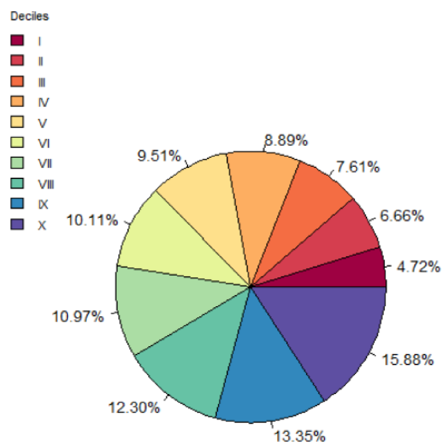


Figure 5: Beverages consumption distribution among deciles

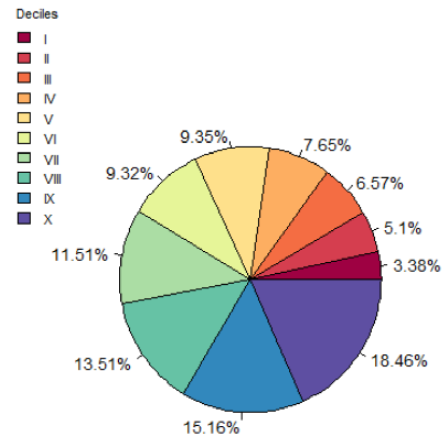


Figure 6: Tobacco consumption distribution among deciles

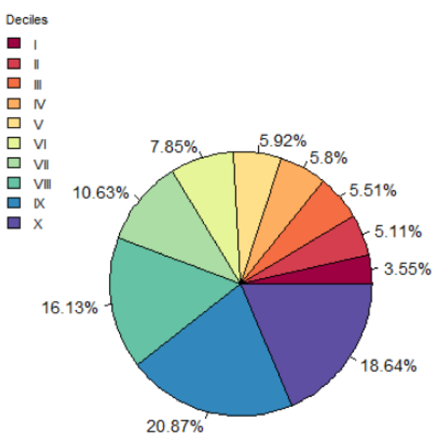


Figure 7: Medicine consumption distribution among deciles

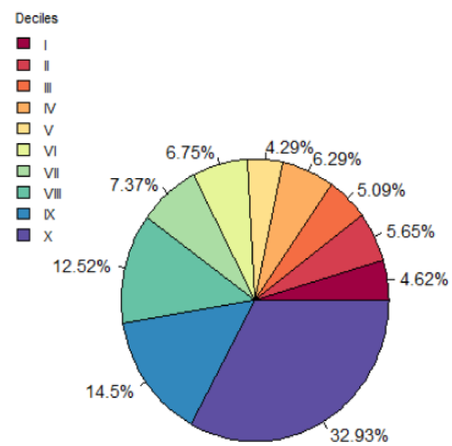


Figure 8: Clothing consumption distribution among deciles

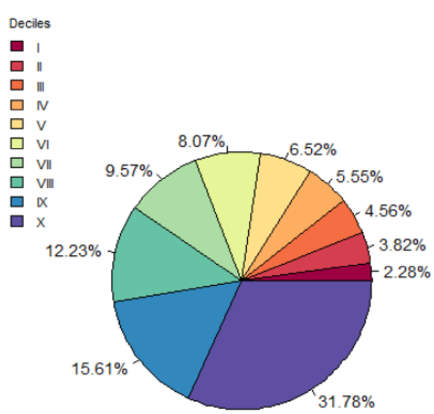


Figure 9: Housing, fuel and light consumption distribution among deciles

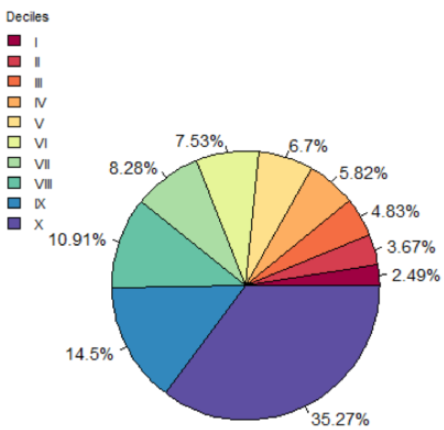


Figure 10: Transport and communication consumption distribution among deciles

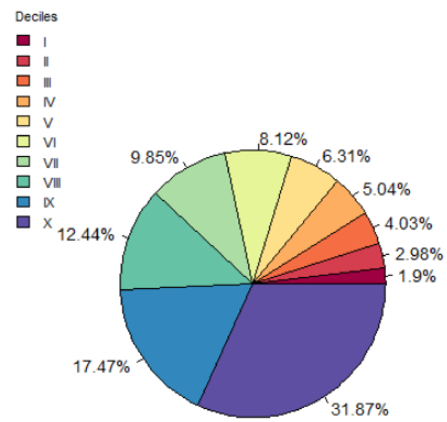


Figure 11: Tradables consumption distribution among deciles

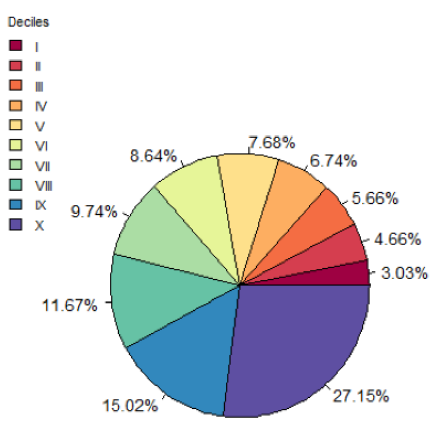
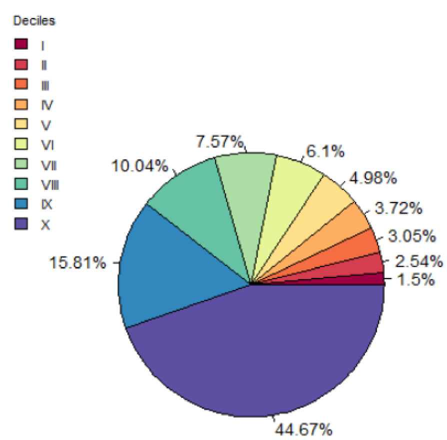


Figure 12: Non-tradables consumption distribution among deciles



Source: Own elaboration with data from INEGI (2014)

2.3 Social Accounting Matrix

Once the aggregation is consistent among the two datasets, the next step is constructing the SAM with one consumer case. Finally, the expansion using the necessary adjustment factor will respect the distribution from the survey extrapolated to a SAM. The purpose of this section is to present the baseline SAM and then explain the adjustments necessary to expand it.

Before we present the baseline SAM, it is essential to note that the model shown in section 2.1 describes much of the operation or organization of the SAM; the reason is that one can think of a SAM as data for a determined year, or as a model, where each cell is representing an algebraic expression in transaction value form (TV), which gives behavioral interpretation about how that number originated. Drud et al. (1985) proposed the latter approach. Note that the election of how to present the model, whether in prices and quantities or TV form, is irrelevant; both are equivalent. We will describe the construction of the SAM with the model as background.

The production side of the economy pays to factors labor and capital, but also an indirect tax over their usage. The value added generated then combines with purchases of intermediate goods, and after the activities pay the respective indirect tax over the production, this constitutes the gross production value. Companies allocate domestic production for either the domestic market or abroad. We assume that the domestic supply is composite with imports. Composite goods for the Mexican case pay excise taxes (one part is paid by the intermediate demand, and the other by the final), and the composite goods fulfilling the final demand are subject to the application of value-added tax. The representative agent receives the factor payments and allocates those resources to save or consume. Over his labor income, he pays a direct tax rate. The government obtains indirect and direct taxation and uses the revenue to save, consume and transfer payments to households. The rest of the world sells their imports and buys our exports; the difference constitutes external savings. The private savings, the public savings, and the external ones equal the investment demand. The way this circular flow schematizes in the form of a SAM is present in Table 3.

Table 3: Schematic SAM

	Value added	Activities	Domestic goods	Exports	Imports	Composite	Final demand	Productive factors	Household income	Household exp	Investment	Indirect tax	Direct tax	Government income	Government exp	Rest of the world
Value added		X^{3}														
Activities			X^{6}	X^{7}												
Domestic goods						X										
Exports																X^{23}
Imports						X										
Composite		X^{4}					X^{12}									
Final demand										X^{18}	X^{19}				X^{22}	
Productive factors	X^{1}															
Household income								X^{14}								
Household exp									X^{15}							
Savings									X^{16}					X^{20}		X^{24}
Indirect tax	X^{2}	X^{5}		X^{8}	X^{9}	X^{11}	X^{13}									
Direct tax									X^{17}							
Government income												X	X			
Government exp														X^{21}		
Rest of the world					X^{10}											

[1] Wage and cost of capital
[2] Factor tax
[3] Value added demand
[4] Intermediate demand
[5] Production tax
[6] Internal sales
[7] Exports
[8] Export tax
[9] Import tax
[10] Imports
[11] Excise tax
[12] Total demand-Intermediate demand
[13] Value added tax
[14] Labor and capital income
[15] Household consumption
[16] Private savings
[17] Income tax
[18] Household demand
[19] Investment demand
[20] Public savings
[21] Government consumption
[22] Government demand
[23] Exports
[24] Foreign savings

Once the databases are in the same goods or sectors, and the one consumer case is consistent, We expand the matrix using the Altimir factor as Casares et al. (2017). Here We present the methodology involved in distributing the factor payments, consumption expenditure, and taxes from the SAM described above to the case of ten consumers. Starting with labor income, we calculate the difference between the total labor income from the input-output table (IO) with the one in the survey (IES). The difference is $\lambda = IO - IES$. Next, we can calculate the Altimir factor as $AF = \frac{\lambda}{IES} + 1$. Finally, the Altimir factor multiplies each decile of labor income data from the survey. The procedure, on the one hand, allows the IO total prevails, and on the other, that represents the distribution given by the IES. Tables 3 and 4 exemplifies the steps. It is straightforward to replicate for the case of capital income, as Table 5 illustrates. A comment deserves the contrast between labor (1.3) and capital (16.2) adjustment factors.

Table 4: Expanding a SAM. Factor payment (Million pesos)

	L	**K**
IO Total factor payment	3648660.919	11012347.97
IES Total factor payment	2744599.745	676769.0798
$\lambda = IO - IES$	904061.1739	10335578.89
$AF = \frac{\lambda}{IES} + 1$	1.329396363	16.27194312

Source: Own elaboration with data from INEGI(2013b) and INEGI(2014)

Table 5: Expanding a SAM. Labor income payment (Million pesos)

	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**Total**
IES	20700.26654	57947.10198	91163.72885	123727.1847	164862.7096	202750.5994	259577.3002	333337.9578	466105.0335	1024427.863	2744599.745
AF	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	1.329396363	
$(AF)(IES)$	27518.85905	77034.66662	121192.7296	164482.4694	219167.8865	269535.9094	345081.1188	443138.2687	619638.3363	1361870.675	3648660.919

Source: Own elaboration with data from INEGI(2013b) and INEGI(2014)

Table 6: Expanding a SAM. Capital income payment (Million pesos)

	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
IES	13544.96484	21438.08941	30761.19645	33310.29273	37433.03223	45538.48333	54809.38223	68492.11722	99797.05891	271644.4625	676769.0798
AF	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	16.27194312	
$(AF)(IES)$	220402.8974	348839.3716	500544.439	542023.1887	609108.1714	740999.6106	891855.1501	1114499.836	1623892.066	4420183.243	11012347.97

Source: Own elaboration with data from INEGI(2013b) and INEGI(2014)

The procedure to disaggregate consumption expenditure follows the same logic as the factor payments expansion. However, it implies a supplemental treatment of taxes, particularly regarding excise and value-added tax. An important aspect to highlight is that the process implicitly considers the distribution of tax payments among different income groups, known as fiscal incidence. The SHCP (2014) study provided the fiscal incidence for excise and value-added tax necessary for this study. Again, the first step is calculating the difference between the figures from the two main data sources, λ, to obtain the Altimir factor. Table 7 depicts the methodology; factors of adjustment are relatively homogenous, except for the case of medicine. The key to expanding consumption expenditure is to work with basic prices.

Table 7: Expanding a SAM. Consumption expenditure (Million pesos)

	Food	Beverages	Tobacco	Medicine	Clothing	Housing, fuel light	Transport and com	Tradable	Non-Tradable
IO private consumption	1336074.716	240809.6457	20409.83187	124201.5166	177692.768	2130280.29	1418384.197	1334093.678	3477323.603
IES total consumption	819900.251	96435.32805	7569.749059	13206.63655	157101.7947	405694.7232	629713.0116	413355.3425	809907.3355
$\lambda = IO - IES$	516174.4655	144374.3176	12840.08281	110994.88	20590.97332	1724585.567	788671.1854	920738.3356	2667416.267
$AF = \frac{\lambda}{IES} + 1$	1.629557638	2.497110245	2.696236257	9.40447752	1.131067715	5.250944043	2.252429553	3.227474139	4.29348328

Source: Own elaboration with data from INEGI(2013b) and INEGI(2014)

To complete the expansion, we show the case of an arbitrary item (tobacco), implying an easy generalization for the other eight. As with factor payments, we respect the data distribution from IES and the total amount from IO. Therefore, the IES data of tobacco consumption distribution among deciles multiply the Altimir factor (see Table 8). Now, consistent with national accounts data in basic terms, we can add the excise tax. The total excise tax per good amount comes from the supply and use tables from INEGI(2013a) and the incidence, as discussed, from SHCP (2014). Process extrapolates for the value-added tax inclusion. Table 9 expresses these steps.

Table 8: Expanding a SAM. Tobacco consumption (Million pesos)

	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
IES	269.060585	386.4466654	416.7178139	438.8473213	447.8955862	594.1044212	804.9085007	1220.928213	1579.83982	1411.000131	7569.749059
AF	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	2.696236257	
(AF)(IES)	725.4509046	1041.951511	1123.569679	1183.236059	1207.632319	1601.845881	2170.223483	3291.910916	4259.621404	3804.389711	20409.83187

Source: Own elaboration with data from INEGI(2013b) and INEGI(2014)

Table 9: Expanding a SAM. Tobacco consumption with taxes (Million pesos)

		Excise tax amount	82.80413299		VAT amount	37261.12	
	(AF)(IES)	Distribution (%)	Payment	(AF)(IES)+Excise Tax	Distribution (%)	Payment	(AF)(IES)+Excise Tax+VAT
I	725.4509046	1.4	1.159257862	726.6101624	3.5	1321.172564	2047.782727
II	1041.951511	2.6	2.152907458	1044.104418	5.1	1898.462453	2942.566872
III	1123.569679	4.3	3.560577718	1127.130256	5.5	2049.425742	3176.555998
IV	1183.236059	4.6	3.808990117	1187.045049	5.8	2158.366938	3345.411987
V	1207.632319	4.8	3.974598383	1211.606917	5.9	2203.027016	3414.633933
VI	1601.845881	7	5.796289309	1607.64217	7.8	2923.125547	4530.767717
VII	2170.223483	11.4	9.43967116	2179.663154	10.6	3963.213437	6142.876591
VIII	3291.910916	17.9	14.8219398	3306.732856	16.1	6012.529074	9319.26193
IX	4259.621404	16.9	13.99389847	4273.615302	20.9	7770.581228	12044.19653
X	3804.389711	29.1	24.0960027	3828.485714	18.7	6961.216	10789.70171
Total	20409.83187	100	82.80413299	20492.636	100	37261.12	57753.756

Source: Own elaboration with data from INEGI (2013a), INEGI(2014) and SHCP(2014)

If the expansion of the matrix to 10 groups of income is consistent (rows equals columns), the model is set to replicate the original benchmark. Table 10 presents the calibration of the relevant parameters for this study, the effective tax rates; We ignored import taxes from the calculation, as they were negligible. Except for Tobacco, most of the rates are close to zero. For the case of VAT, Casares et al. (2015) explains that the low effective tax rates obey exemptions, special treatments, and tax evasion.

Table 10: Effective tax rates (%)

	Factor tax	**Excise**	**Value-added**		**Income tax**
Food	2.8	0.3	0	I	0
Beverages	3.3	0.5	27.6	II	0.1
Tobacco	0.9	0.4	169.6	III	0.3
Medicine	11	0.09	0	IV	0.3
Clothing	8.6	0.04	15.6	V	0.5
Housing fuel and light	2.7	-0.5	-0.4	VI	0.7
Transport and communication	4.2	-0.7	4.7	VII	1.2
Tradable	6.6	0.02	7.6	III	1.4
Non-tradable	8	0.4	2.6	IX	2.1
				X	17.2

Source: Own elaboration. Parameters calibrated with SAM

2.4 Construction of social utility functions

Studying the sensitivity of the efficiency cost of taxation to the equity criterion requires some value judgment to add the equivalent variations. For this reason, We suggest utilizing a social welfare function. Social welfare functions enable comparisons of an individual's utility by multiplying it with a common "price" or valorization, usually based on equity. In this manner, it is possible to cast how much weight or worth has for the government a determined group. We suggest the form of equation (27) to serve that purpose. The rationale is that each value of e in (28) characterizes a particular way to bundle the ten groups of income in one individual.

$$W(V_1, V_2, ..., V_{10}) = \sum_{i}^{10} \omega_i V_i \tag{27}$$

$$\omega_i = (\frac{I_1}{I_i})^e \tag{28}$$

Note, however, that thanks to the specification above, the grouped individual each e creates has attached a set of distributional values. The latter is because, in the case of this function, the poorest household income is normalized; according to Ahmad & Stern (1990), the term e represents an inequality aversion parameter since when it increases, the function is weighing fewer incomes more apart from the poorest household. Remark how greater values of e converge to evaluate society's well-being with the poorest household utility. Therefore, higher values of the inequality aversion parameter measure the efficiency cost of taxes upon the burden or redistribution imposed on the lower income deciles. The study limits to evaluate six possible values for the parameter ($e \in \{0, 0.5, 1, 2, 5, \lim_{e \to \infty}\}$), understanding that a continuum of society's possible attitudes towards distribution exists between them, but also, covering the endpoints. When $e = 0$ is analogous to assessing the cost of taxation grounded purely on efficiency criteria, the focus of vast previous literature, and when we consider the limit case endpoint, all that matters relapse over the first decile (also known as the Rawlsian scenario).

After explaining the construction of these six "social" individuals, it is important to clarify how we got to the estimates. First, we shock the original equilibrium through changes of 1% in the specified effective tax rates per type of instrument and type of good (τ). As discussed in Section 1, we follow a balanced budget approach. Consequently, the welfare loss associated with the tax disturbance per peso of extra revenue is equation (29). Nevertheless, worth noting that the experiment yields six corresponding equivalent variations, so the MEB is subject to e. The Hicksian equivalent variation is a straightforward measure for whichever case since utility functions obey a Cobb-Douglas specification (see (30) and (31)), where E_e refers to the expenditure function, U is the level of utility, $\mathbf{p}$ is a vector of prices and I is the level of income. The superscript refers to an evaluation of the latter measures before (0) and after (1) changes in τ.

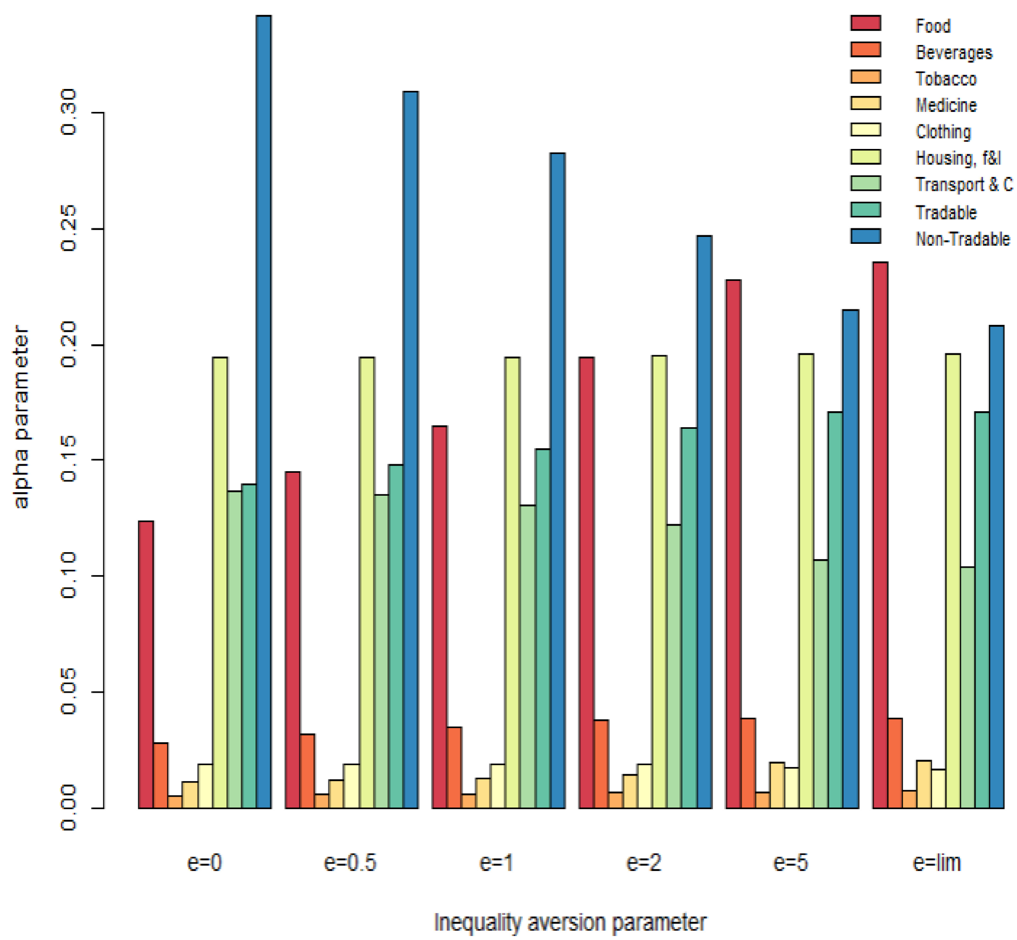
$$MEB_{e,\tau} = -\frac{EV_{e,\tau}}{\Delta R_\tau} \tag{29}$$

$$EV_{e,\tau} = E_e(\mathbf{p}^0, U^1) - E_e(\mathbf{p}^0, U^0) \tag{30}$$

$$E_e(\mathbf{p}^0, U^1) = I^1 \prod_{i=1}^{9} (\frac{p_i^0}{p_i^1})^{\alpha_i} \tag{31}$$

Hence, as (31) presumes, the parameter α_i is important in determining the respective results per inequality aversion value. Alpha interpretation is standard, the share of disposable income representing the consumption of good i. Figure 13 presents how the shares α_i vary as the inequality aversion parameter changes. As e increases, it emulates the respective shares of the first decile, as we anticipate.

Figure 13: α_i per inequality aversion parameter



Source: Own elaboration

3 Results

Table 11 reports the welfare loss from an increment of 1% in the effective value-added tax per type of good per additional unit of revenue, given an inequality aversion parameter. For example, society's distributional attitude toward inequality is low $e = 0.50$. In that case, the welfare loss incurred from a 1% increase in the effective tax of food is 1.023 pesos per peso of extra revenue. Of course, a direct interpretation could be of the type, given a determined parameter of inequality aversion (e), the society's cost from the government to obtain an additional unit from a determined instrument is the corresponding number in the table. The "All" row refers to the same interpretation as earlier when we simultaneously shock all the effective value-added tax rates.

Table 11: Efficiency cost of Value-added Tax

	e					
	0	0.5	1	2	5	LIM
Food	1.920	1.023	0.614	0.291	0.113	0.087
Beverages	5.433	2.625	1.457	0.616	0.208	0.155
Tobacco	8.066	3.923	2.101	0.943	0.314	0.255
Medicine	5.135	2.411	1.328	0.572	0.215	0.164
Clothing	5.333	2.468	1.322	0.539	0.176	0.129
Housing F L	3.867	1.770	0.940	0.382	0.128	0.096
Transport C	4.620	2.098	1.096	0.428	0.135	0.099
Tradable	3.836	1.754	0.929	0.374	0.124	0.097
Non-tradable	4.342	1.932	0.997	0.387	0.122	0.099
All	3.940	1.790	0.941	0.375	0.123	0.091
Average	4.728	2.223	1.198	0.504	0.171	0.131
Min	1.920	1.023	0.614	0.291	0.113	0.087
Max	8.066	3.923	2.101	0.943	0.314	0.255
Std	1.649	0.799	0.425	0.196	0.066	0.054

Descriptive statistics reveal a great deal of information surrounding potential applications. For example, for all values of the inequality aversion parameter, the society's cost from the government obtaining additional revenue from food is the lowest. Some results, however, are biased; for example, tobacco, since it is departing from the highest effective tax rate, the model overestimates society's cost in the absence of negative externalities. Another result that deserves comment is that when inequality is not relevant at all, $e = 0$ price of taxation is that high since society from that set of values does not gain anything (the gain in equity has value cero), and when societies value equality at a high degree, the loss in efficiency is not relevant, the latter derive in a lower cost of taxation. Furthermore, the structure of the model contemplates transfers, so the distribution improves as equity criteria raise its importance.

Table 12: Efficiency cost Income tax

	e					
	0	0.5	1	2	5	LIM
I	6.260	4.008	3.107	2.492	2.208	2.172
II	6.544	3.543	2.240	1.171	0.351	0.110
III	4.186	2.238	1.362	0.633	0.145	0.099
IV	4.536	2.347	1.362	0.571	0.132	0.083
V	4.553	2.289	1.279	0.499	0.110	0.074
VI	4.173	2.047	1.111	0.413	0.096	0.068
VII	4.356	2.055	1.077	0.387	0.098	0.071
VIII	4.388	2.008	1.023	0.359	0.099	0.073
IX	3.808	1.650	0.802	0.271	0.078	0.057
X	3.621	1.435	0.675	0.241	0.076	0.057
All	4.060	1.854	0.980	0.392	0.129	0.095
Average	4.642	2.362	1.404	0.704	0.339	0.286
Min	3.621	1.435	0.675	0.241	0.076	0.057
Max	6.544	4.008	3.107	2.492	2.208	2.172
Std.	0.976	0.804	0.734	0.682	0.662	0.663

Table 12 assesses the same possible interpretations from the income tax perception. The higher costs from this type of tax come from obtaining additional revenue from lower-income deciles. For example, taxing decile 10 has the lowest associated MEB in the limit case for inequality aversion. Two features are relevant to this type of tax. The first is that contrary to consumption, where departing from a high effective tax rate significantly increases the cost like tobacco, in this case, taxing more the individuals who pay the higher effective tax rate has lower efficiency cost. The other important characteristic is that as per the closure rule of the model, labor supply is fixed and fully employed; therefore, the cost of taxation, in this case, is underestimated since is not account for the distortion that income taxation provokes overestimates in labor markets.

Table 13: Efficiency cost Import taxes

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	4.475	2.160	1.201	0.517	0.183	0.138
Beverages	7.260	3.527	1.986	0.850	0.287	0.214
Tobacco	10.823	4.924	2.634	1.197	0.396	0.325
Medicine	4.569	2.134	1.167	0.497	0.182	0.138
Clothing	5.322	2.459	1.318	0.539	0.177	0.130
Housing F L	3.453	1.599	0.857	0.350	0.118	0.088
Transport C	3.489	1.604	0.860	0.353	0.119	0.089
Tradable	3.926	1.796	0.952	0.383	0.127	0.094
Non-tradable	3.495	1.617	0.868	0.357	0.121	0.091
All	3.740	1.716	0.911	0.369	0.123	0.091
Average	5.201	2.424	1.316	0.560	0.190	0.145
Min	3.453	1.599	0.857	0.350	0.118	0.088
Max	10.823	4.924	2.634	1.197	0.396	0.325
Std	2.432	1.119	0.610	0.286	0.094	0.079

Table 13 provides the efficiency costs for import taxes. Even though most products have a close to zero effective tax rate within this tax instrument, their associated welfare cost is considerably higher than the ones revised so far. The results could be responding to a high degree of Armington elasticity substitution. However, housing fuel and light have consistently lower costs than goods with no strong production chain with the rest of the world, like nontradable goods. With these estimates, we can reject that non-necessarily goods that depart from the high effective tax will have high-efficiency costs; the case of Tabacco, however, maintains as highly distortive.

Table 14: Efficiency cost Excise tax

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.321	1.190	0.695	0.318	0.120	0.092
Beverages	5.376	2.596	1.439	0.608	0.205	0.153
Tobacco	7.844	3.866	2.070	0.929	0.310	0.251
Medicine	4.633	2.168	1.185	0.503	0.184	0.139
Clothing	5.244	2.428	1.300	0.530	0.174	0.127
Housing F L	3.902	1.780	0.942	0.380	0.126	0.094
Transport C	4.049	1.836	0.959	0.375	0.118	0.087
Tradable	3.754	1.728	0.920	0.373	0.124	0.092
Non-tradable	4.296	1.925	1.001	0.392	0.125	0.092
All	3.888	1.775	0.938	0.377	0.124	0.092
Average	4.602	2.169	1.168	0.490	0.165	0.125
Min	2.321	1.190	0.695	0.318	0.118	0.087
Max	7.844	3.866	2.070	0.929	0.310	0.251
Std	1.514	0.759	0.405	0.189	0.063	0.053

Table 14 presents the results for the excise taxes, whose rationale is purely collection. Estimates behave in a similar way to the value-added tax case because now, beverages have the highest effective tax rate and, only behind tobacco, are the most distortive, and, again, food stands out with a considerably much lower MEB than the rest, even though the effective tax rate is the third most high of the particular instrument. This effect is not contaminated by the zero effective tax of the VAT since medicines also are modeled with zero tax, and their MEB, in this case, is relatively high.

Table 15: Efficiency cost Factor tax

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.040	1.075	0.640	0.300	0.115	0.088
Beverages	5.425	2.614	1.449	0.612	0.207	0.154
Tobacco	7.452	3.651	1.956	0.874	0.293	0.236
Medicine	4.729	2.197	1.200	0.508	0.185	0.140
Clothing	4.822	2.227	1.191	0.484	0.158	0.116
Housing F L	4.022	1.841	0.977	0.396	0.133	0.099
Transport C	4.277	1.954	1.028	0.406	0.130	0.096
Tradable	3.838	1.767	0.941	0.382	0.127	0.094
Non-tradable	4.235	1.897	0.986	0.385	0.123	0.091
All	4.045	1.840	0.969	0.387	0.127	0.094
Average	4.538	2.136	1.152	0.483	0.163	0.124
Min	2.040	1.075	0.640	0.300	0.115	0.088
Max	7.452	3.651	1.956	0.874	0.293	0.236
Std	1.438	0.705	0.374	0.172	0.057	0.048

Table 15 presents the efficiency cost of taxation in the case of factor taxes; again, food remains the lower cost, consistently for all levels of the inequality aversion parameter. The measure of efficiency cost of taxes is robust not just to identify potential gains in welfare within a particular instrument but to make comparisons across systems to enhance more significant benefits. To make those comparisons, the best statistic is to compare the average MEB per tax instrument; the interpretation remains as discussed. For example, given an inequality aversion parameter of 2, on average, the cost of society associated with an additional monetary unit of government revenue from income tax is around 0.704 pesos. This is how much, on average, society loses per another unit of government revenue generated from a determined tax instrument. To make the analysis more accessible and to respond to the question of how the possibilities of gains change as our distributional values do, Table 17 presents the ranks from lowest to high MEB, note that consistently the factor tax remains as the instrument with the lowest efficiency cost associated for all levels of inequality aversion. Also, when we ignore equity criteria, income taxes have a relatively low social cost. However, from a reasonable distributional concern onwards, income taxes remain the most distortionary taxes in the system.

Table 16: Average welfare cost per instrument

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	4.538	2.136	1.152	0.483	0.163	0.124
Excise tax	4.602	2.169	1.168	0.490	0.165	0.125
Import tax	5.201	2.424	1.316	0.560	0.190	0.145
VAT	4.728	2.223	1.198	0.504	0.171	0.131
Income tax	4.642	2.362	1.404	0.704	0.339	0.286

Table 17: Rank from low to high average MEB (baseline)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1	1	1	1	1	1
Excise tax	2	2	2	2	2	2
Import tax	5	5	4	4	4	4
VAT	4	3	3	3	3	3
Income tax	3	4	5	5	5	5

From the exercise developed here, it is fair to ask if the Mexican tax system should transition to a system focused on taxing consumption. According to this analysis, for example, if the effective tax rate of income tax lowers, efficiency gains are the most significant from the system, but with them, losses in equity. However, those losses are to be assumed by a society with specific distributional values; it is like they are willing to accept.

Since the estimations correspond to a balanced budget type of analysis is worth asking for the robustness of these relations for different uncompensated elasticities, specifically in the capital and labor decisions. We test for two cases, one where the substitution elasticity among labor and capital is relatively low ($\sigma_{va} = 0.5$) and the other case where it is relatively high ($\sigma_{va} = 1.5$). The complete disclosure of results per instrument tax according to each type of elasticity is in the appendix.

Table 18: Average welfare cost per instrument Low substitution case ($\sigma_{va} = 0.5$)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	4.474	2.104	1.130	0.468	0.153	0.114
Excise tax	4.557	2.147	1.153	0.478	0.156	0.117
Import tax	5.262	2.446	1.320	0.553	0.180	0.136
VAT	4.681	2.200	1.183	0.492	0.162	0.122
Income tax	4.496	2.294	1.360	0.673	0.317	0.264

Table 19: Rank from low to high average MEB (Low substitution case)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1	1	1	1	1	1
Excise tax	3	2	2	2	2	2
Import tax	5	5	4	4	4	4
VAT	4	3	3	3	3	3
Income tax	2	4	5	5	5	5

Note that in Table 19, the rank of MEB under a low elasticity scenario, other than minor differences for the case where $e = 0$, reproduces precisely the results derived in Table 17. On the other hand, for the high case scenario, table 21 derives somehow different results, specifically for the last two inequality aversion parameters, excise tax and value-added are the less costly but exist consistency regarding income tax as the higher MEB.

Table 20: Average welfare cost per instrument high substitution case ($\sigma_{va} = 1.5$)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	4.895	2.300	1.254	0.548	0.206	0.161
Excise tax	4.524	2.135	1.164	0.510	0.191	0.149
Import tax	6.053	2.811	1.536	0.677	0.254	0.199
VAT	4.969	2.334	1.269	0.552	0.205	0.159
Income tax	5.265	2.643	1.580	0.821	0.418	0.352

Table 21: Rank from low to high average MEB (High substitution case)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	2	2	2	2	3	3
Excise tax	1	1	1	1	1	1
Import tax	5	5	4	4	4	4
VAT	3	3	3	3	2	2
Income tax	4	4	5	5	5	5

Analyzing the standard deviation is important as it can indicate the number of opportunities for reform for a specific tax instrument. As within a determined tax instrument, the standard deviation is big, far from the ideal situation where MEB across the system is the same.

Table 22: Std MEB by instrument baseline

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1.438	0.705	0.374	0.172	0.057	0.048
Excise tax	1.514	0.759	0.405	0.189	0.063	0.053
Import tax	2.432	1.119	0.610	0.286	0.094	0.079
VAT	1.649	0.799	0.425	0.196	0.066	0.054
Income tax	0.976	0.804	0.734	0.682	0.662	0.663

Table 23: Rank from low to high Std MEB (baseline)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	2	1	1	1	1	1
Excise tax	3	2	2	2	2	2
Import tax	5	5	4	4	4	4
VAT	4	3	3	3	3	3
Income tax	1	4	5	5	5	5

From Table 23, we can interpret that income tax is not only the most costly but is the instrument with greater reform opportunities at a relative distance from the ideal equalization of MEB (when all feasible efficiency improvements vanish). For low levels of inequality aversion, greater opportunities are for import taxes.

Table 24: Std MEB by instrument low substitution case ($\sigma_{va} = 0.5$)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1.4650	0.7223	0.3882	0.1845	0.0668	0.0565
Excise tax	1.5417	0.7760	0.4198	0.2025	0.0736	0.0624
Import tax	2.4006	1.1103	0.6114	0.2956	0.1043	0.0878
VAT	1.6238	0.7976	0.4314	0.2082	0.0769	0.0651
Income tax	0.8320	0.7530	0.7090	0.6701	0.6564	0.6599

Table 25: Rank from low to high Std MEB (low substitution case)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	2	1	1	1	1	1
Excise tax	3	3	2	2	2	2
Import tax	5	5	4	4	4	4
VAT	4	4	3	3	3	3
Income tax	1	2	5	5	5	5

Again, testing for robustness, table 25 replicates Table 23, with minor differences when $e = 0.5$. Table 27, again, is consistent with the information in Table 23, with import and income taxes as significant opportunities to reform. Finally, the last experiment consisted of simultaneously increasing all the effective taxes (tax instruments and sectors) by 1%; the result derived an estimation for the welfare cost of the Mexican tax system, as shown in Table 28.

Table 26: Std MEB by instrument high substitution case ($\sigma_{va} = 1.5$)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1.121	0.561	0.286	0.118	0.025	0.019
Excise tax	1.401	0.678	0.335	0.134	0.027	0.022
Import tax	2.389	1.052	0.541	0.225	0.057	0.044
VAT	1.548	0.732	0.370	0.149	0.036	0.027
Income tax	1.301	0.944	0.809	0.719	0.682	0.680

Table 27: Rank from low to high Std MEB (high substitution case)

	0	**0.5**	**1**	**2**	**5**	**LIM**
Factor tax	1	1	1	1	1	1
Excise tax	3	2	2	2	2	2
Import tax	5	5	5	4	4	4
VAT	4	3	3	3	3	3
Income tax	2	4	4	5	5	5

Table 28: MEB whole system

	0	**0.5**	**1**	**2**	**5**	**LIM**
$\sigma_{va} = 0.5$	3.799	1.733	0.910	0.355	0.108	0.078
Baseline	3.917	1.788	0.945	0.379	0.125	0.092
$\sigma_{va} = 1.5$	4.283	1.959	1.056	0.456	0.179	0.140

4 Conclusions

This paper constitutes a first effort to provide an overview of how costly taxes are for society in Mexico, conciliating the fact that taxes are one of the most powerful instruments to alleviate inequality. Therefore, with this line of thought, one can not conceive a real cost of a tax if it is grounded based on only one criterion; if this is the case, the cost will be underestimated or overestimated according to a set of distributional values that a determined society chooses. Moreover, in reality, no society puts value cero a gain in equity; if this were the case, taxes would be highly costly. Therefore, one of the essential features of interpreting results throughout the study was to give an efficiency cost attached, or related first to equity criteria, implying that even though most of the time opposed, in policy, they are inseparable, and the paper tries to step further that respect.

Three main findings are consistent; the first is that given any aversion to inequality greater than zero, the income tax in Mexico proved to be the most distortive tax instrument. This means this tax has the most welfare cost per additional monetary unit of government revenue. Income tax resulted in the highest and the most dispersed, indicating it is the farthest instrument from optimally equating the MEB. The second result concerns the least distortive instrument tax, the factor tax. To this respect, possible explanations arise; the first is that effective taxes are so homogenous and small to this respect, that the small exogenous change does not represent any cost any significant resource allocation among sectors, implying a near zero substitution effect. The second possible explanation for this result might rely on aggregating the social contributions from the SAM; the significant capital payments could potentially bias the factor tax measure. The third result concerns the low social cost of foodstuffs, considering even the most restrictive inequality aversion. In this case, there is a direct policy implication in a country where expanding the base of taxpayers is indispensable.

It is essential to acknowledge the scope and limitations of the study. As We mentioned, the model represented a point of departure, so more than limitations, most of them refer to very welcome extensions of this baseline, which include but are not restricted to, endogenized decisions of labor supply and savings, imperfect labor markets, informality, public goods, externalities (see Parry (2001)), imperfect competition, tax evasion and corruption among other topics to extend on the efficiency cost of taxes. However, which is crucial that whichever path is chosen, equity criteria must accompany it. The study represents a step forward for Mexico in what Feldstein (1997) considers the most important issue to address in public finance: measuring the cost of incremental tax revenue.

A Appendix

This section presents the full disclosure of the results of the robustness test, working with low and high substitution elasticity between labor and capital.

Table 29: Efficiency cost of VAT- High substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	1.961	1.042	0.629	0.304	0.124	0.097
Beverages	5.460	2.651	1.483	0.642	0.229	0.173
Tobacco	7.960	3.829	2.004	0.850	0.242	0.191
Medicine	5.156	2.431	1.348	0.592	0.231	0.177
Clothing	5.406	2.535	1.392	0.608	0.230	0.176
Housing F L	4.334	1.981	1.072	0.470	0.190	0.150
Transport C	5.067	2.293	1.217	0.511	0.195	0.152
Tradable	4.420	2.026	1.101	0.487	0.199	0.157
Non-tradable	4.958	2.215	1.175	0.505	0.203	0.160
All	4.392	1.999	1.076	0.468	0.187	0.148
Average	4.969	2.334	1.269	0.552	0.205	0.159
Min	1.961	1.042	0.629	0.304	0.124	0.097
Max	7.960	3.829	2.004	0.850	0.242	0.191
Std	1.548	0.732	0.370	0.149	0.036	0.027

Table 30: Efficiency cost of Income tax- High substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
I	7.618	4.590	3.443	2.693	2.340	2.287
II	7.418	3.944	2.487	1.329	0.454	0.199
III	4.710	2.486	1.524	0.744	0.220	0.132
IV	4.974	2.558	1.508	0.681	0.201	0.142
V	5.995	2.937	1.645	0.690	0.213	0.161
VI	4.751	2.291	1.255	0.509	0.164	0.128
VII	4.383	2.073	1.113	0.442	0.152	0.121
VIII	4.439	2.031	1.059	0.415	0.154	0.123
IX	4.334	1.902	0.964	0.378	0.148	0.118
X	4.025	1.621	0.797	0.327	0.137	0.110
All	4.556	2.082	1.124	0.490	0.196	0.154
Average	5.265	2.643	1.580	0.821	0.418	0.352
Min	4.025	1.621	0.797	0.327	0.137	0.110
Max	7.618	4.590	3.443	2.693	2.340	2.287
Std	1.301	0.944	0.809	0.719	0.682	0.680

Table 31: Efficiency cost of Import tax- High substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	4.466	2.172	1.226	0.548	0.210	0.162
Beverages	7.309	3.571	2.032	0.895	0.322	0.245
Tobacco	10.721	4.837	2.546	1.112	0.331	0.267
Medicine	4.627	2.188	1.224	0.553	0.226	0.177
Clothing	5.412	2.542	1.404	0.624	0.243	0.188
Housing F L	5.113	2.346	1.273	0.559	0.224	0.177
Transport C	3.594	1.703	0.965	0.456	0.200	0.161
Tradable	4.406	2.017	1.095	0.484	0.198	0.156
Non-tradable	8.823	3.919	2.060	0.862	0.328	0.255
All	4.279	1.963	1.068	0.473	0.194	0.153
Average	6.053	2.811	1.536	0.677	0.254	0.199
Min	3.594	1.703	0.965	0.456	0.198	0.156
Max	10.721	4.837	2.546	1.112	0.331	0.267
Std	2.389	1.052	0.541	0.225	0.057	0.044

Table 32: Efficiency cost of Excise tax- High substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.505	1.271	0.744	0.349	0.140	0.109
Beverages	3.939	1.944	1.106	0.488	0.179	0.136
Tobacco	7.740	3.774	1.975	0.837	0.238	0.188
Medicine	4.678	2.210	1.229	0.546	0.217	0.169
Clothing	3.670	1.733	0.963	0.433	0.173	0.134
Housing F L	4.403	2.012	1.088	0.476	0.192	0.151
Transport C	4.710	2.147	1.150	0.492	0.191	0.150
Tradable	4.284	1.971	1.073	0.473	0.192	0.151
Non-tradable	4.787	2.150	1.146	0.494	0.198	0.156
All	4.329	1.979	1.069	0.466	0.185	0.146
Average	4.524	2.135	1.164	0.510	0.191	0.149
Min	2.505	1.271	0.744	0.349	0.140	0.109
Max	7.740	3.774	1.975	0.837	0.238	0.188
Std	1.401	0.678	0.335	0.134	0.027	0.022

Table 33: Efficiency cost of Factor tax- High substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	3.128	1.546	0.886	0.406	0.160	0.124
Beverages	5.467	2.653	1.489	0.652	0.238	0.181
Tobacco	7.379	3.584	1.888	0.808	0.241	0.191
Medicine	4.773	2.238	1.243	0.550	0.218	0.169
Clothing	4.897	2.295	1.263	0.555	0.213	0.165
Housing F L	4.594	2.102	1.139	0.500	0.202	0.159
Transport C	4.598	2.097	1.125	0.483	0.189	0.148
Tradable	4.419	2.026	1.100	0.485	0.197	0.156
Non-tradable	4.804	2.162	1.154	0.498	0.199	0.157
All	4.508	2.053	1.106	0.481	0.192	0.151
Average	4.895	2.300	1.254	0.548	0.206	0.161
Min	3.128	1.546	0.886	0.406	0.160	0.124
Max	7.379	3.584	1.888	0.808	0.241	0.191
Std	1.121	0.561	0.286	0.118	0.025	0.019

Table 34: Efficiency cost of VAT- Low substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.192	1.146	0.678	0.314	0.119	0.091
Beverages	5.425	2.618	1.450	0.609	0.203	0.150
Tobacco	8.093	3.947	2.126	0.968	0.334	0.272
Medicine	5.129	2.406	1.322	0.566	0.211	0.160
Clothing	5.314	2.451	1.303	0.521	0.162	0.116
Housing F L	3.879	1.766	0.929	0.366	0.114	0.083
Transport C	4.178	1.901	0.988	0.376	0.109	0.078
Tradable	3.679	1.682	0.884	0.345	0.104	0.074
Non-tradable	4.237	1.885	0.965	0.361	0.103	0.073
All	3.830	1.738	0.908	0.351	0.106	0.076
Average	4.681	2.200	1.183	0.492	0.162	0.122
Min	2.192	1.146	0.678	0.314	0.103	0.073
Max	8.093	3.947	2.126	0.968	0.334	0.272
Std	1.624	0.798	0.431	0.208	0.077	0.065

Table 35: Efficiency cost of Income tax- Low substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
I	6.216	3.967	3.064	2.450	2.175	2.142
II	5.013	2.886	1.901	1.030	0.294	0.065
III	4.696	2.462	1.469	0.663	0.144	0.063
IV	5.013	2.555	1.460	0.596	0.118	0.067
V	4.951	2.459	1.357	0.515	0.103	0.066
VI	4.147	2.023	1.085	0.388	0.077	0.051
VII	3.849	1.830	0.955	0.328	0.069	0.048
VIII	3.674	1.679	0.842	0.276	0.062	0.043
IX	3.780	1.647	0.799	0.263	0.067	0.047
X	3.623	1.431	0.665	0.226	0.063	0.044
All	3.961	1.808	0.948	0.369	0.111	0.080
Average	4.496	2.294	1.360	0.673	0.317	0.264
Min	3.623	1.431	0.665	0.226	0.062	0.043
Max	6.216	3.967	3.064	2.450	2.175	2.142
Std	0.832	0.753	0.709	0.670	0.656	0.660

Table 36: Efficiency cost of Import tax- Low substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	4.464	2.151	1.191	0.507	0.175	0.131
Beverages	7.246	3.515	1.974	0.839	0.278	0.206
Tobacco	10.847	4.946	2.657	1.219	0.414	0.340
Medicine	4.554	2.119	1.152	0.482	0.171	0.128
Clothing	5.298	2.438	1.295	0.517	0.160	0.114
Housing F L	4.341	1.999	1.058	0.419	0.129	0.094
Transport C	3.461	1.578	0.833	0.326	0.098	0.070
Tradable	3.681	1.684	0.885	0.345	0.104	0.075
Non-tradable	3.462	1.586	0.835	0.325	0.096	0.068
All	3.609	1.655	0.872	0.341	0.104	0.075
Average	5.262	2.446	1.320	0.553	0.180	0.136
Min	3.461	1.578	0.833	0.325	0.096	0.068
Max	10.847	4.946	2.657	1.219	0.414	0.340
Std	2.401	1.110	0.611	0.296	0.104	0.088

Table 37: Efficiency cost of Excise tax- Low substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.295	1.174	0.683	0.310	0.115	0.087
Beverages	5.368	2.588	1.431	0.600	0.199	0.148
Tobacco	7.871	3.891	2.096	0.954	0.329	0.268
Medicine	4.621	2.157	1.174	0.492	0.175	0.131
Clothing	5.224	2.410	1.281	0.512	0.159	0.114
Housing F L	3.899	1.775	0.931	0.364	0.112	0.081
Transport C	3.997	1.822	0.950	0.364	0.107	0.077
Tradable	3.630	1.670	0.883	0.348	0.106	0.077
Non-tradable	4.109	1.838	0.947	0.358	0.104	0.074
All	3.751	1.712	0.898	0.350	0.106	0.077
Average	4.557	2.147	1.153	0.478	0.156	0.117
Min	2.295	1.174	0.683	0.310	0.104	0.074
Max	7.871	3.891	2.096	0.954	0.329	0.268
Std	1.542	0.776	0.420	0.203	0.074	0.062

Table 38: Efficiency cost of Factor tax- Low substitution

	0	**0.5**	**1**	**2**	**5**	**LIM**
Food	2.033	1.068	0.633	0.293	0.110	0.083
Beverages	5.414	2.604	1.438	0.602	0.199	0.147
Tobacco	7.472	3.668	1.974	0.892	0.306	0.248
Medicine	4.718	2.187	1.188	0.497	0.176	0.132
Clothing	4.803	2.209	1.172	0.466	0.144	0.103
Housing F L	3.756	1.720	0.907	0.358	0.112	0.081
Transport C	4.125	1.885	0.985	0.380	0.112	0.081
Tradable	3.844	1.760	0.926	0.362	0.110	0.079
Non-tradable	4.098	1.837	0.947	0.359	0.104	0.074
All	3.925	1.785	0.933	0.362	0.109	0.079
Average	4.474	2.104	1.130	0.468	0.153	0.114
Min	2.033	1.068	0.633	0.293	0.104	0.074
Max	7.472	3.668	1.974	0.892	0.306	0.248
Std	1.465	0.722	0.388	0.185	0.067	0.056

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