Chapter 11

A Model for Estimating the Number of Taxpayer That Fullfill Mexican Income Law

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Additional information is available at the end of the chapter

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Abstract

In this chapter, methodologies for estimating the total number of taxpayers in Mexico's tributary system are proposed. The methodologies are based on the theory of optimization and consist of an initial model with differentiated results, a prototype model with constant and differentiated returns, and a generic model for Mexican income tax (ISR). Based on the theoretical results, the models permit to estimate efficiently the expected number of contributors under different scenarios. Moreover, when the estimated data is contrasted with official data, they give satisfactorily results. The proposed models may be even adaptable to the inner conditions of Mexican tributary authority and may become an important tool for the Mexican government in their overall fiscal process.

Keywords: fiscal models, estimation, optimization models, returns, taxes

1. Introduction

1.1. Tributary incomes and active base of contributors

In Mexico, within the category of tributary incomes, taxes like ISR (income tax), IVA (value-added tax), IEPS (special tax on goods and services), IGI (general tax on imports), and other concepts, in the first quarter of 2016, reach $723,130 million pesos. This quantity represented an increase of 6.1% compared with the value in the first quarter of the previous year [1]. More specifically, these taxes experimented an increase for ISR of 8.3%, IVA in 5.2%, and IGI 1.1% [1, 2].

The collection for the period January–March 2016 is of special importance since it reached $93,585 more than the expected in LIF (Federal income law) [1, 3–8]. On the other hand, the tax

collection from 2010 to 2015 indicated that more than 90% comes from ISR and IVA and the percentage for ISR was 49.71% in 2010, 55.67% in 2011, 57.74% in 2012, and 57.98% in 2013. The percentage for IVA in the same period was 40.02, 41.51, 44.12, and 35.65%, respectively. It is important to note that the percentage of IEPS with respect to the total reaches only 0.03% in 2010 and presented a deficit in 2011 and 2013. Only until the year 2014, IEPS reach a positive increase of 6.17%. Based on the above information, it is clear that there is a need to estimate the composition of contributors since they are valuable for the tax collection process. This work concentrates in this problem and presents several models that attempt to estimate the expected number of contributors.

According to official information [1], the active base of contributors is composed by all individuals, employees, and entities which in a determined moment are active in the Federal Taxpayer Registry (RFC in Spanish) under a fiscal regime. Up to the year 2010, the number of individuals with respect to the total represented 36.68%, the employees 59.38%, and entities 4.23%.

Taking into account the number of contributors from the year 2010 until March 2016, it was found that the number of employees is surprisingly high reaching 61.64% followed by individuals which are 34.54% and entities represent only 3.82% [1] (**Figure 1**).

1.2. Works based on contributors

In the following, a brief description of the works related to the study of tax contributors is presented. The description is focused in a more Latin-American context. Méndez, Morales, and Aguilera [9] presented a study in which contributors were considered a part of a whole and in which the development of people depends on them, but only a few of them are leading the group. The authors claim that when performing an analysis on contributors, compliance to the tributary authorities is demanded since it plays a significant role in the removal or addition of profits in their payments. They conclude that in order to have a wider and efficient number of contributors, consideration on perception, sociocultural profile of individuals, and the design

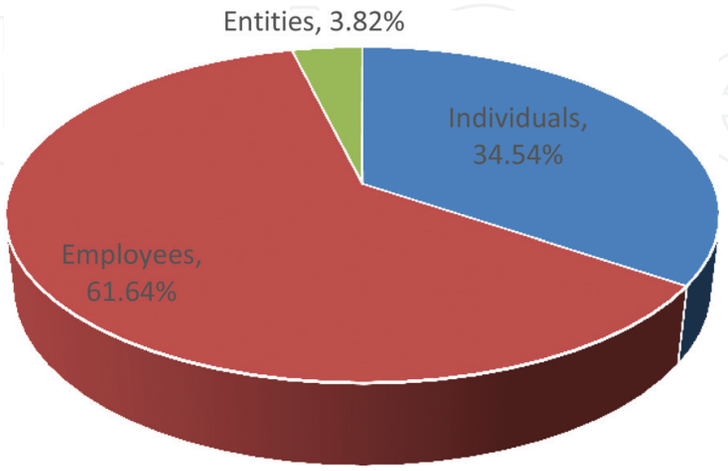

Figure 1. Composition of the active base of contributors considering general averages in 2010–2016. Source: Compiled by the authors with data from the tributary and management report up to the first quarter of 2016.

of adequate policies that enhance the perception on transparency and accountability are needed. Giarrizzo and Brudersohn [10], on the other hand, considered that the role of the government as a regulatory and executor agency was not always convenient for the public administration; therefore, a positive correlation in the "exert pressure does not necessarily mean more tax collection" cannot be established. In contrast, they propose incentives for individuals and companies which comply properly with the taxpaying process, thus rewarding their efforts via fiscal incentives in a clear and directed way. They consider, however, that although this approach of incentives works well in Argentina, their proposal can be well adapted to the present work by quantifying the number of contributors with maximum tax burden and establishing incentives based on this. Javier Tapia [11] using a more legal research presented the theory of the relation of power, the theory of relation of legal-tributary, and the theory of tributary function.

Rodriguez [12] highlights the importance of equality to maintain a positive perception of the base number of contributors and considers taxing financial operations. Absalón and Urzúa [13] highlight the need to analyze the base number of contributors per categories or subgroups in the same way this work does. Absalón [13] presented the effect of a fiscal reform and suggests that the negative effects are intimately related to the different regimes, categories, or group of contributors. By the use of microdata, they suggest that the impact could have been identified in specific groups, regimes, or categories.

There is a growing interest to quantify the impact of fiscal imposition on social inequality. Flores [14] analyzes the increase of value-added tax (IVA) on the poorest people and emphasizes the need for a deeper revision of a fiscal reform and claims that a tax on certain goods and services should not impact to the poorest ones.

Gómez [15] presented a study of the fiscal impact on different population layers and proposed an approach to absorb the taxpaying process to enhance the tax collection. For this, they highlight productivity in the employment via an endogenous model, and they propose direct charges to the level of revenues of people. With this, they claim that it will result in social welfare and tributary equality. For more information regarding the study of fiscal policies, reforms, and the application of mathematical methods for studying contributors, the reader is referred to the following studies [16–25].

2. Methodology

2.1. Base information for developing the proposed models

The methodologies presented in this chapter are based on optimization models; the interested reader may refer to the following references for the theory [26–31]. The variables for developing an optimization model, applied to the active base of contributors, originated from the expected collection in the income law for the fiscal years 2015 and 2016 and the number of contributors up to the fourth quarter of 2015 and first quarter of 2016. **Table 1** shows the number of contributors according to the individuals, employees, and entities categories

considered in the tributary and management report [1, 2] and fiscal regimes [32–34]. **Tables 2** and **3** include the collection of ISR, IVA, and IEPS.

It was important to establish within each category the ratio of participation in monetary units with respect to three classes of taxes as shown in the following tables (**Tables 4** and **5**):

Types of contributors	Third quarter of 2015 (millions of contributors)	Fourth quarter of 2015 (millions of contributors)	First quarter of 2016 (millions of contributors)
Individuals	19.4	19.9	19.9
Employees	29.5	29.9	30.2
Entities	1.8	1.8	1.8
Total	50.7	51.6	51.9

Source: Compiled by authors with data from the tributary and management report up to the first quarter of 2016.

Table 1. Contributors according to the class reported in the tributary and management report.

Tax	Millions of pesos	Relation with respect to total (%)
ISR	1059206.20	55
IVA	703848.50	37
IEPS	159970.60	8
Total tax collection	1923025.30	100

Source: Compiled by authors with data from federal income law for the fiscal year of 2015 [4].

Table 2. Collection of ISR, IVA, and IEPS according to the LIF of 2015.

Concept	Federal income law of 2015 (millions of pesos)	Federal income law of 2016 (millions of pesos)	Percentage (%) of increase
ISR	1′059206.20	1′249299.5	**17.95**
IVA	703848.50	741988.7	**5.42**
IEPS	159970.60	348945.2	**18.13**

Source: Compiled by authors with data from the federal income law in the 2015 and 2016 fiscal years.

Table 3. Variation in the estimated collection for ISR, IVA, and IEPS (2015–2016).

Types of contributors	ISR (%)	IVA (%)	IEPS (%)	Total (%)
Individuals	21	14.12	3.21	39
Employees	32	21.21	4.82	58
Entities	2	1.28	0.29	3
Total	55	37	8	100

Source: Compiled by authors.

Table 4. Ratio of participation in taxes (LIF 2015) per number contributors up to the fourth quarter of 2015.

Types of contributors	ISR	IVA	IEPS	Total
Individuals	408492.31	271445.45	61694.09	741631.85
Employees	613764.83	407850.20	92696.14	1114311.17
Entities	36949.05	24552.85	5580.37	67082.28
Total	1059206.20	703848.50	159970.60	1923025.30

Source: Compiled by the authors.

Table 5. Participation of each category with respect to the number of contributors per tax class up to the fourth quarter of 2015 (millions of pesos).

The fiscal regimes, on the other hand, have 15 categories for each tax class, and the details are considered in Section 4 along with their corresponding proposals.

3. Models for optimizing the active base of contributors per categories

3.1. Initial model

3.1.1. Structure and assessment

The first approach was to develop a model applicable to the fiscal year of 2016 and the previous ones. The OF will consider the constant returns per million contributors up to the fourth quarter of 2015, and this will multiply the optimized number of contributors with the three tax categories considered in the tributary and management reports. The final results are the incomes by ISR, IVA, and IEPS included in the fiscal year of 2015 (**Table 2**)

$$Maximize = R_{4T2015PF}\tau + R_{4T2015AS}\varphi + R_{4T2015PM}\omega \quad (1)$$

The initial model should be permitted to display the time evolution of the active base of contributors with respect to the three tax categories. The returns considered the total revenues of 2015 with respect to the census or active base of contributors up to the fourth quarter of 2015, and the restrictions were with respect to the previous quarter. The restrictions are the following[1]:

- Active base of contributors: millions of contributors up to the fourth quarter of 2015
- Individuals: millions of active contributors according to the third quarter tributary and management report of 2015
- Employees: millions of contributors according to the third quarter tributary and management report of 2015

[1]The first restriction considers the number of contributors at the end of the financial year, i.e., at the fourth quarter of 2015; however, the rest of restrictions consider the number of contributors at the previous exercise (third quarter of 2015). This allows to obtain the optimal combination and evolution of the model and to compare it with the official information at the end of the financial year (fourth quarter). The comparison constitutes an indicator of the diversity or not of the tax burden, if there is a need to increase the number of contributors in a category of whether the active base should not be increased.

- Entities: millions of active contributors according to the third quarter tributary and management report of 2015

$$\tau + \varphi + \omega \leq \theta \tag{2}$$

$$\tau \geq \theta_1 \tag{3}$$

$$\varphi \geq \theta_2 \tag{4}$$

$$\omega \geq \theta_3 \tag{5}$$

where $\tau = individuals$, $\varphi = employees$, $\omega = entities$, $\theta = active\ contributors\ roll, in\ millions$; $\theta_\tau = active\ roll\ of\ individuals, in\ millions$; $\theta_\varphi = active\ roll\ of\ employees, in\ millions$; and $\theta_\omega = active\ roll\ of\ entities, in\ millions$.

Based on the above, the initial model is the following:

Model 1

Returns per million contributors	**Maximize**
$R_{4T2015PF} = Fourth\ quarter\ return, individuals$ $R_{4T2015AS} = Fourth\ quarter\ return, employees$ $R_{4T2015PM} = Fourth\ quarter\ return, entities$	$R_{4T2015PF}\tau + R_{4T2015AS}\varphi + R_{4T2015PM}\omega$

Restriction variables	**Subjected to**					
1	θ Active base of contributors up to the fourth quarter of 2015 (millions of contributors)	τ	φ	ω	$\leq$	θ
2	θ_1 Individuals (active contributors up to the third quarter of 2015, in millions)	τ			$\geq$	θ_1
3	θ_2 Employees (active contributors up to the third quarter of 2015, in millions)		φ		$\geq$	θ_2
4	θ_3 Entities (active contributors up to the third quarter of 2015, in millions)			ω	$\geq$	θ_3

Source: Compiled by authors

The estimated returns, R_{4T2015}, (for 2015) per million contributors, is determined by the total returns considered in the LIF of 2015 multiplied for each class of contributors with respect to the total, and the result of this is divided by the number of contributors for each class according to the tributary and management report of the fourth quarter of 2015[2]:

[2]The data is contained in **Tables 1** and **2** and in pages 30 and 31. It is important to note that for the initial model, the return per million contributors is constant in all categories but not for the following scenarios:

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$$R_{2015}\tau = \left[\frac{1923025.3*0.39}{19.9}\right] = 37726.93$$

$$R_{2015}\varphi = \left[\frac{1923025.3*0.58}{29.9}\right] = 37726.93$$

$$R_{2015}\varphi = \left[\frac{1923025.3*0.03}{1.8}\right] = 37726.93$$

Based on the above, the OF is given by

$$Maximize = 37267.93\tau + 37267.93\varphi + 37267.93\omega \tag{6}$$

Subjected to restrictions

$$\begin{cases} 1\tau + 1\varphi + 1\omega \leq 51.60 \\ 1\tau + 0\varphi + 0\omega \geq 19.40 \\ 0\tau + 1\varphi + 0\omega \geq 29.50 \\ 0\tau + 0\varphi + 1\omega \geq 1.80 \end{cases}$$

$$\tau, \varphi, \omega \geq 0$$

The results obtained by using the PHP Simplex tool [35] and replicated with Solver in Excel were the following: $\tau = 20.30$ (*individuals, in million contributors*), $\varphi = 29.50$ (*employees, in million contributors*), and $\omega = 1.80$ (*entities, in million contributors*).

Based on the optimized number of contributors, the product of these variables with the returns, i.e., the maximized results of (6), is tested for equality with total revenue by ISR, IVA, and IEPS within the LIF for 2015.

$$Maximize = 37267.93(20.30) + 37267.93(29.5) + 37267.93(1.8)$$

$$Maximize = 1923025.20$$

As can be noted, the optimized results for the total revenue by ISR, IVA, and IEPS are the same with respect to the approved LIF for the fiscal year 2015[3] (**Table 2**). The proposed model indicates, however, in this scenario of constant returns per million contributors, that a better choice would be to increase the number of individuals to 20.3 million instead of the one reported in the tributary form of the fourth quarter of 2015 in which this number reaches 19.9 million. The difference, however, was in the number of employees that went from 29.5 to 29.9 million contributors [2].

[3] A ten-decimal place's difference exists due to the fact that only two decimal points were considered for the returns per million contributors; otherwise, the result would be exact.

3.2. A model with differentiated returns

Using the proposed model of the above section, the next model considers several types of returns per million contributors with respect to three categories, a condition that can be well estimated and updated by SAT. For this, $34,000 is considered for individuals, $35,963.57 for employees, and $75,000 for entities which results in an OF of the following form:

$$Maximize = 34000\tau + 35963.57\varphi + 75000\omega \tag{7}$$

The restrictions were 51.60 million contributors as the maximum allowed and that corresponds to the total number of contributors of the tributary and management report of the fourth quarter of 2015 and also the restriction which corresponds to the official number of contributors up to the third quarter of 2015 and that will allow to know the optimal change in each category.

Model 2

Returns per million contributors	**Maximize**
$R_{dif2015PF}$ = *Differenced returns, individuals* $R_{dif2015\ AS}$ = *Differenced returns, employees* $R_{dif2015PM}$ = *Differenced returns, entities*	$R_{dif2015PF}\tau + R_{dif2015AS}\varphi + R_{dif2015PM}\omega$

Restriction variables	**Subjected to**					
1	θ Active base of contributors up to the fourth quarter of 2015 (millions of contributors)	τ	φ	ω	≤	θ
2	θ_1 Individuals (active contributors up to the third quarter of 2015, in millions)	τ			≥	θ_1
3	θ_2 Employees (active contributors up to the third quarter of 2015, in millions)		φ		≥	θ_2
4	θ_3 Entities (active contributors up to the third quarter of 2015, in millions)			ω	≥	θ_3

Source: Compiled by the authors

$$\begin{cases} 1\tau + 1\varphi + 1\omega \leq 51.60 \\ 1\tau + 0\varphi + 0\omega \geq 19.40 \\ 0\tau + 1\varphi + 0\omega \geq 29.50 \\ 0\tau + 0\varphi + 1\omega \geq 1.80 \end{cases}$$

$$\tau, \varphi, \omega \geq 0$$

The results obtained by using the PHP Simplex tool [35] and replicated with Solver in Excel were the following: $\tau = 19.40$ *Individuals* (*in million contributors*), $\varphi = 29.50$ *Employees*

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(*in million contributors*), and $\omega = 2.70$ *Entities* (*in million contributors*). Based on the optimized number of contributors, the product of these variables by the returns, i.e., the maximized result of (7), is compared with the total revenues by ISR, IVA, an IEPS within the LIF of 2015 (**Table 2**), i.e., $1923025.30.

Using the maximized OF of Eq. (7), the following is obtained:

$$Maximize = 34,000(19.4) + 35963.57(29.5) + 75,000(2.70)$$

$$Maximize = 1923025.31$$

Unlike the model with constant returns, in this model that considers distinct returns, the increase should have been registered in entities, and if this is not the case, the original way of considering contributors is preferred instead, even though this situation is uneven with respect to tax participation.

3.3. Prototype model with constant returns

In the following, an approach called prototype model (PM), whose objective is to give tax authorities a better idea of the capacity to adequate tax policies to obtain optimized results, is presented. The first approach is a model with constant returns[4] and whose objective function to maximize is

$$Maximize = 37929.49\tau + 37929.49\varphi + 37929.49\omega \tag{8}$$

In this new proposal[5], the restriction for entities to be at least 2.5 million contributors will be modified. Also, an additional restriction concerning the total number of active contributors and distributed in two classes (employees and entities) is that this should be at least 34.43 million.

$$\begin{cases} 1\tau + 1\varphi + 1\omega \leq 61.70 \\ 1\tau + 0\varphi + 0\omega \geq 19.40 \\ 0\tau + 1\varphi + 0\omega \geq 29.50 \\ 0\tau + 0\varphi + 1\omega \geq 2.05 \\ 0\tau + 1\varphi + 1\omega \geq 34.43 \end{cases}$$

$$-\tau, \varphi, \omega \geq 0$$

[4]With the purpose of verifying the time evolution of the results in a broader range, in this scenario the returns are obtained by dividing the total revenues by ISR, IVA, and IEPS within the LIF of 2015 by the total number of contributors up to the third quarter of 2015 in the tributary and management report. Unlike the model derived above, this model considers to obtain the returns by ISR, IVA, and IEPS in the LIF of 2016.

[5]The number 61.7 in the first restriction represents the total number of active contributors estimated for late 2016. The quantities 19.40, 29.50, and 1.80 correspond to the active census up to the third quarter of 2015.

Model 3						
Return per million contributors $R_{3T2015PF}$ = *Return for the third quarter of* **2015**, *Individuals* $R_{3T2015\ AS}$ = *Return for the third quarter of* **2015**, *Employees* $R_{3T2015PM}$ = *Return for the third quarter of* **2015**, *Entities*		**Maximize** $R_{3T2015PF}\tau + R_{3T2015AS}\varphi + R_{3T2015PM}\omega$				
Restriction Variables	**Subjected to**					
1	θ Active base of contributors, estimated for 2016 (in million contributors)	τ	φ	ω	$\leq$	θ
2	θ_1 Individuals (millions of active contributors, third quarter of 2015)	τ			$\geq$	θ_1
3	θ_2 Employees (millions of active contributors, third quarter of 2015)		φ		$\geq$	θ_2
4	δ_1[6] Minimum number of contributors for entities (in million contributors)			ω	$\geq$	δ_1
5	δ_2 Minimum required number of contributors for employees and entities (in million contributors)		φ	ω	$\geq$	δ_2

Source: Compiled by the authors

The results obtained with the PHP Simplex tool [35] and replicated with Solver of MS Excel were the following: $\tau = 27.27$ *million contributors, individuals*; $\varphi = 32.38$ *million contributors, employees*; and $\omega = 2.05$ *million contributors, entities*.

Based on the optimized number of contributors, the product of these variables by the returns, i.e., the maximized result of (19), is compared with the total revenue by ISR, IVA, and IEPS, in this case, considering the LIF of 2016. Maximizing, again, the OF of (19) results in

$$Maximize = 37929.49(27.27) + 37929.49(32.38) + 37929.49(2.05)$$

$$Maximize = 2340249.53^{7}$$

The above result represents the total expected tax collection for 2016 considering ISR, IVA, and IEPS. The results present differences in decimals due to the fact that only two decimal points were considered in the returns; however, by using the complete decimals, the result would be exact.

[6]The variable δ_n will be used for restrictions that are set in accordance with goals and objectives of tax authorities.

[7]Value corresponds to the sum of the revenues for 2016 included in the federal law of incomes (LIF) (**Table 3**).

Model 4

Returns per million contributors	**Maximize**
$R_{dif\,2016PF} = 2016$ *differenced returns, Individuals*	$R_{dif\,2016PF}\tau + R_{dif\,2016AS}\varphi + R_{dif\,2016PM}\omega$
$R_{dif\,2016\ AS} = 2016$ *differenced returns, Employees*	
$R_{dif\,2016PM} = 2016$ *differenced returns, Entities*	

Restriction variables	**Subjected to**					
1	θ Estimated active base of contributors for 2016 (in millions of contributors)	τ	φ	ω	$\leq$	θ
2	θ_1 Individuals (millions of active contributors up to the fourth quarter of 2015)	τ			$\geq$	θ_1
3	θ_2 Employees (millions of active contributors up to the fourth quarter of 2015)		φ		$\geq$	θ_2
4	δ_1[8] Minimum number of contributors (entities) (in million contributors)			ω	$\geq$	δ_1
5	δ_2 Minimum number of contributors (employees and entities) (in million contributors)		φ	ω	$\geq$	δ_2
6	δ_3 Minimum number of contributors (individuals and entities) (in million contributors)		φ	ω	$\geq$	δ_3

Source: Compiled by authors

3.4. Prototype model with differentiated returns

In the following a model which considers increments per million contributors, where each contributor may lie within three categories, is presented (the categories may be adjusted by fiscal authorities when needed). Moreover, a restriction which considers a minimum number of contributors in the employees and entities categories is added (as before these categories may be adjusted by the goals and objectives of the fiscal authorities). The model proposes to maximize the following objective function:

$$Maximize = 40239.19\tau + 35963.57\varphi + 37000\omega \tag{9}$$

An additional restriction is the condition that the total number of contributors (in million contributors) will reach at least 22.50

[8]The variable δ_n will be used for restrictions that depend upon goals and objectives of the fiscal authorities.

$$\begin{cases} 1\tau + 1\varphi + 1\omega \leq 61.70 \\ 1\tau + 0\varphi + 0\omega \geq 19.90 \\ 0\tau + 1\varphi + 0\omega \geq 29.90 \\ 0\tau + 0\varphi + 1\omega \geq 2.05 \\ 0\tau + 1\varphi + 1\omega \geq 34.43 \\ 1\tau + 0\varphi + 1\omega \geq 22.50 \end{cases}$$

$$-\tau, \varphi, \omega \geq 0$$

The results obtained by using the PHP Simplex tool [35] and replicated with MS Excel Solver are the following: $\tau = 27.27$ *million contributors, individuals*; $\varphi = 29.90$ *million contributors, employees*; and $\omega = 4.53$ *million contributors, entities*.

Based on the optimized number of contributors, the next steps are to multiply these variables by the returns, i.e., the maximized result of (9), and to compare it with the total revenues by ISR, IVA, and IEPS for equality.

Using the maximized OF, (9) results in

$$Maximize = 40239.19(27.27) + 35963.57(29.90) + 37000(4.53)$$

$$Maximize = 2340243.40^{9}$$

The above result represents the total tax collection expected for 2016 for taxes ISR, IVA, and IEPS. Using exact quantities with all decimals will result in an exact value.

4. Models to optimize the base number of contributors per fiscal regime

4.1. Generic model for ISR

In the following a generic model for ISR is presented. The model is structured in accordance to the official information up to September 31 of 2015 and obtained via a request of public information [33]. The authorities detail that the total number of contributors up to September 31[10], registered up to the 2009 exercise, is 11,107,553; however, in order to give an example for the following model, we will take the total number of contributors as 16,752,516. To test the model, constant returns are considered for each contributor, and these can be obtained by

[9] Quantity that corresponds to the sum of incomes for the year 2016 and included in the federal income law (**Table 3**)

[10] In addition, the authority claims with respect to the requirement of information that "the requested information are not part of the data that the administrative unit makes periodically, however, the transparency agencies provide data relative to the fiscal regime up to September 31, 2015 which corresponds to the contributors of ISR…"

dividing the total collection of ISR in the fiscal year 2015 which is $1059206.20 (in million pesos) by the total number of contributors which is 16,752,516 and which results in an approximated return per contributor of 0.0632 million pesos[11]. The objective function will be represented by the returns of each fiscal regime reported by the authority. Restrictions are composed of the total number of contributors (for this case it is greater than the one reported on September 2015 which is 17,000,000[12]), and consequently a better tax collection is expected than the one that was considered for the base of the returns. The following restrictions (14 in total) will correspond each to the total number of contributors per regime[13]; the number of residents abroad without a permanent establishment in Mexico is at least 200. Also, the restriction, wages, salaries, and similar regime together with the fiscal incorporation regime are at least 10,600,000 contributors[14]. In the following, the notation is presented[15]:

$$R_{\theta_n} = \text{Return per restriction variable}$$

$$\theta = \text{Total number of contributors for ISR(in accordance to official goals and objectives)}$$

$$\theta_1 = \text{Wages and salaries regime and wages like incomes (official data)}$$

$$\theta_2 = \text{Fiscal incorporation regime (official data)}$$

$$\theta_3 = \text{Individuals with enterprise and professional activities regime (official data)}$$

$$\theta_4 = \text{General regime for the law of entities (official data)}$$

$$\theta_5 = \text{Regimen de Arrendamiento (dato oficial)}$$

$$\theta_6 = \text{Incomes by dividends regime (partners and shareholders), official data}$$

$$\theta_7 = \text{Agriculture, forestry, livestock and PF and PM fishing regime (official data)}$$

$$\theta_8 = \text{Regime for the rest of incomes (official data)}$$

$$\theta_9 = \text{Incomes by interests regime (official data)}$$

$$\theta_{10} = \text{Entities with non} - \text{profit purposes (official data)}$$

$$\theta_{11} = \text{Producers cooperatives that defer their incomes (official data)}$$

$$\theta_{12} = \text{Regime of coordinated (official data)}$$

$$\theta_{13} = \text{Corporate groups regime (official data)}$$

[11]For all the proposed models, the returns may be updated with constant quantities for each contributor or with differentiated quantities with respect to each regime and in accordance to the latest information of the fiscal authorities.

[12]The maximum expected number of contributors could be set according to the goals and objectives of the fiscal authorities; the model presented in this work is exemplified.

[13]In accordance to the official number of contributors reported by the authority [33].

[14]These two restrictions represent examples in which additional restrictions may be derived (in accordance to the goals and objectives of the fiscal authorities).

[15]The number of contributors for each regime is found in the inequalities of the presented notation.

$$\theta_{14} = \text{Regime of consolidated (official data)}$$

$\delta_1 =$ Individuals residing abroad without a physical estabishment in Mexico (restricted to 200)

$\delta_2 =$ Wages and salaries regime and fiscal incorporation regimeR (restricted to $10,600,000$).

Generic model for ISR

Objective function for ISR:

$$R_{\theta_1} + R_{\theta_2} + R_{\theta_3} + R_{\theta_4} + R_{\theta_5} + R_{\theta_6} + R_{\theta_7} + R_{\theta_8} + R_{\theta_9} + R_{\theta_{10}} + R_{\theta_{11}} + R_{\theta_{12}} + R_{\theta_{13}} + R_{\theta_{14}}$$

with the following restrictions:

$$\begin{cases} 1\theta_1 + 1\theta_2 + 1\theta_3 + 1\theta_4 + 1\theta_5 + 1\theta_6 + 1\theta_7 + 1\theta_8 + 1\theta_9 + 1\theta_{10} + 1\theta_{11} + 1\theta_{12} + 1\theta_{13} + 1\theta_{14} \leq \theta \\ 1\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_1 \\ 0\theta_1 + 1\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_2 \\ 0\theta_1 + 0\theta_2 + 1\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_3 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 1\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_4 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 1\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_5 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 1\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_6 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 1\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_7 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 1\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_8 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 1\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_9 \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 1\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_{10} \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 1\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_{11} \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 1\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \theta_{12} \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 1\theta_{13} + 0\theta_{14} \geq \theta_{13} \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 1\theta_{14} \geq \vartheta_{14} \\ 0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\vartheta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 1\theta_{14} \geq \delta_1 \\ 1\theta_1 + 1\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq \delta_2 \end{cases}$$

Generic model for ISR

Objective function for ISR:

$$R_{\theta_1} + R_{\theta_2} + R_{\theta_3} + R_{\theta_4} + R_{\theta_5} + R_{\theta_6} + R_{\theta_7} + R_{\theta_8} + R_{\theta_9} + R_{\theta_{10}} + R_{\theta_{11}} + R_{\theta_{12}} + R_{\theta_{13}} + R_{\theta_{14}}$$

with the following restrictions:

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$$
\begin{cases}
1\theta_1 + 1\theta_2 + 1\theta_3 + 1\theta_4 + 1\theta_5 + 1\theta_6 + 1\theta_7 + 1\theta_8 + 1\theta_9 + 1\theta_{10} + 1\theta_{11} + 1\theta_{12} + 1\theta_{13} + 1\theta_{14} \leq 17000000 \\
1\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 6155456 \\
0\theta_1 + 1\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 4444544 \\
0\theta_1 + 0\theta_2 + 1\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 3764639 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 1\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 1496588 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 1\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 547070 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 1\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 324011 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 1\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 187716 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 1\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 45000 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 1\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 18337 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 1\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 5577 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 1\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 5043 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 1\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 3918 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 1\theta_{13} + 0\theta_{14} \geq 1275 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 1\theta_{14} \geq 626 \\
0\theta_1 + 0\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\vartheta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 1\theta_{14} \geq 200 \\
1\theta_1 + 1\theta_2 + 0\theta_3 + 0\theta_4 + 0\theta_5 + 0\theta_6 + 0\theta_7 + 0\theta_8 + 0\theta_9 + 0\theta_{10} + 0\theta_{11} + 0\theta_{12} + 0\theta_{13} + 0\theta_{14} \geq 10600000
\end{cases}
$$

The generic model of ISR presented above along with their objective function permitted to obtain a tax collection for $1,074,400. Due to the fact that two restrictions conditioned the increase of certain fiscal regimes below the one expected in the LIF. The optimized number of contributors with the above restrictions are $\boldsymbol{\theta_1}=\mathbf{6,155,456}$; $\boldsymbol{\theta_2}=\mathbf{4,444,544}$; $\boldsymbol{\theta_3}=\mathbf{3,764,639}$; $\boldsymbol{\theta_4}=\mathbf{1,349,998}$; $\boldsymbol{\theta_5}=\mathbf{547,070}$; $\boldsymbol{\theta_6}=\mathbf{324,011}$; $\boldsymbol{\theta_7}=\mathbf{187,716}$; $\boldsymbol{\theta_8}=\mathbf{45,000}$; $\boldsymbol{\theta_9}=\mathbf{18,337}$; $\boldsymbol{\theta_{10}}=\mathbf{5,577}$; $\boldsymbol{\theta_{11}}=\mathbf{5,043}$; $\boldsymbol{\theta_{12}}=\mathbf{3,918}$; $\boldsymbol{\theta_{13}}=\mathbf{1,275}$; $\boldsymbol{\theta_{14}}=\mathbf{626}$; and $\boldsymbol{\theta_{15}}=\mathbf{200}$.

As can be noted, the differences are presented in three of the fiscal regimes. In wages, salaries, and similar regime, the official value went from 6,056,971 to 6,155,456; in the leasing regime went from 547,070 to 693,660; and finally in the other incomes, regime went from 42618.00 to 45000. In the individuals residing abroad without a physical establishment, regime went from 173 to 200 contributors.

5. Conclusions

The initial model presented as an evidence of their functionality and based on official information up to the fiscal year 2015 permitted to establish a relation between the active number of contributors and the expected collection in the LIF. This meant that the approach may be used under other distinct scenarios.

The performance of the prototype model for the first scenario and that complies with LIF of 2016 adds as restrictions to the official number of individuals and employees and two more additional restrictions and sets as a minimum goal to obtain at least 2.05 million entities. The

second restriction which states that the sum of employees and entities will reach at least 34.43 million resulted in the number of individuals should be 27.27 million, employees 32.38 million, and entities 2.70 million contributors.

The above proposals not only permit to adapt the model to the returns of the fiscal authorities but also allow to establish restrictions whose data are from previous exercises (such as the prototype models presented above). It is important to note that some scenarios presented in this work are based on the returns obtained from official data; therefore, in case of failing to obtain, an active census for each category will result in an additional fiscal burden for the same number of contributors, and moreover it will maintain a risky trend from the last 10 years in which only individuals and employees are increasing but not entities.

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